Nokia Customer Care

Service Manual

RM-88 (Nokia E62)

Mobile Terminal

Part No: 9250256 (Issue 1)

COMPANY CONFIDENTIAL

NOKIA

Nokia E62 Service Manual Structure

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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- Title of the Document + Issue Number/Date of publication
- Latest Amendment Number (if applicable)
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Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

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IMPORTANT

This document is intended for use by qualified service personnel only.

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	06/2006	ET	

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1 — General Information

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BP-5L	1500	up to 6 hrs	up to 12 days

Charging times

ACP-4
2 h 10 min

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15ºC...+55ºC	Specifications fulfilled
Reduced performance	-25ºC...-15ºC +55ºC...+70ºC	Operational for shorts periods only
Intermittent operation	-40ºC...-15ºC +70ºC...+85 ºC	Operation not guaranteed but an attempt to operate does not damage the phone.
No operation or storage	<-40ºC...>+85ºC	No storage or operation: an attempt may damage the phone.
Charging allowed	-25ºC...+50ºC	
Long term storage conditions	0ºC...+85ºC	

DC characteristics

Signal	Min	Nom	Max	Note
VBAT	3.1V	3.7V	4.2V (charging high limit voltage	3.1V SW cut off

Enhancement	Type
Advanced Car Kit	CK-7W
Mobile Charger	DC-4

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T)	Weight (g)	Volume (cm^3)
Transceiver with BP-5L 1500mAh li-ion battery back	117.1 x 69.7 x 17.8 / 13.3 mm	144 (including BP-5L battery)	103.4

Main RF characteristics for GSM850/900/1800/1900 phones

Parameter	Unit
Cellular system	GSM850, EGSM900 and GSM1800/1900
Rx frequency band	GSM850: 869-894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
Tx frequency band	GSM850: 824-849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
Output power	GSM850: +5 ... + 33 dBm/3.2mW .. 2W
	GSM900: +5...+31.2dBm / 3.2mW.. 1.3 W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: 0...30.9dBm/1.0mW... 1.26W
Number of RF channels	GSM850: 123
	GSM900: 173
	GSM1800: 373
	GSM1900: 298
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16

Enhancement	Type
Wireless Boom Headset	HS-4W
Wireless Headset	HDW-3
Wireless Headset	HS-26W
Wireless Headset	HS-11W
Wireless Clip-on Headset	HS-21W
Wireless Headset	HS-36W
Wireless Headset	HS-58W

Table 2 Data

Enhancement	Type
Connectivity cable	DKE-2
Mini SD card 128 MB	MU-17
Mini SD card 256 MB	MU-18
Mini SD card 512 MB	MU-23
Mini SD card 1GB	MU-24

Table 3 Power

Enhancement	Type
Battery	BP-5L
Nokia Compact Charger	AC-3U
Nokia Travel Charger	AC-4U
Charger Adapter	CA-44

Table 4 Messaging

Enhancement	Type
Wireless Keyboard upgrade	SU-8W

Table 5 Positioning

Enhancement	Type
Wireless GPS Module update	LD-1W

Table 6 Car

Enhancement	Type
Wireless Plug-in Car Handsfree	HF-6W

Productivity

- SMS, MMS and email
- MS Word, PowerPoint , Excel and Adobe PDF viewers
- PIM (Calendar & Contacts)
- Internet browser
- Video streaming (3GPP)
- Logs (last calls , timers and history list)
- Instant messaging
- Java™ MIDP 2.0, CLDC 1.13D API, PIM API, File access API
- MP3
- Data Transfer
- Settings Wizard/Access Point Configurator

Sales package

- Transceiver RM-88
- BP-5L Li-ion Battery Cell
- AC-4U Charger
- User Guide
- CD-ROM
- Headset HS-40
- USB Cable DKE-2
- Quick Start Guide

Product and module list

Module name	Type code	Notes
System/RF Module	1QR	Main PWB with components
EL-Dome sheet		
Chassis Assy		
Display Module		
Keyboard		
A-cover Assy		
SW Module		

Mobile enhancements

Table 1 Audio

Enhancement	Type
Mono Headset	HS-40
Basic Stereo Headset	HS-47

RM-88 product selection

RM-88 is a GSM handportable phone, supporting the EGSM 850/900/1800/1900 bands.

The MMS implementation follows the OMA MMS standard release 1.2.

WAP 2.0 compatible browser supports XHTML Mobile Profile (MP) and uses a TCP/IP stack to communicate with a gateway in network.

RM-88 uses Symbian 9.1a operating system and supports also MIDP Java 2.0 & CLDC1.1, providing a good platform for 3rd party applications.

Figure 1 View of RM-88

RM-88 product features and sales package

Bearers & transport

- GSM Quadband World Phone E850/900/1800/1900 EGPRS (class B, Multislot class 11)

Software platform

- SW platform: Nokia Series 60 rel 3.0

Connectivity

- Bluetooth (Headset & Handsfree profiles, BIP, GOP)
- Mini SD Card
- Mini-USB interface
- PC Suite connectivity with USB & Bluetooth

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Table of Contents

List of Tables

List of Figures

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2 — Parts Lists and Component Layouts

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Table of Contents

List of Figures

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Exploded view

Exploded view

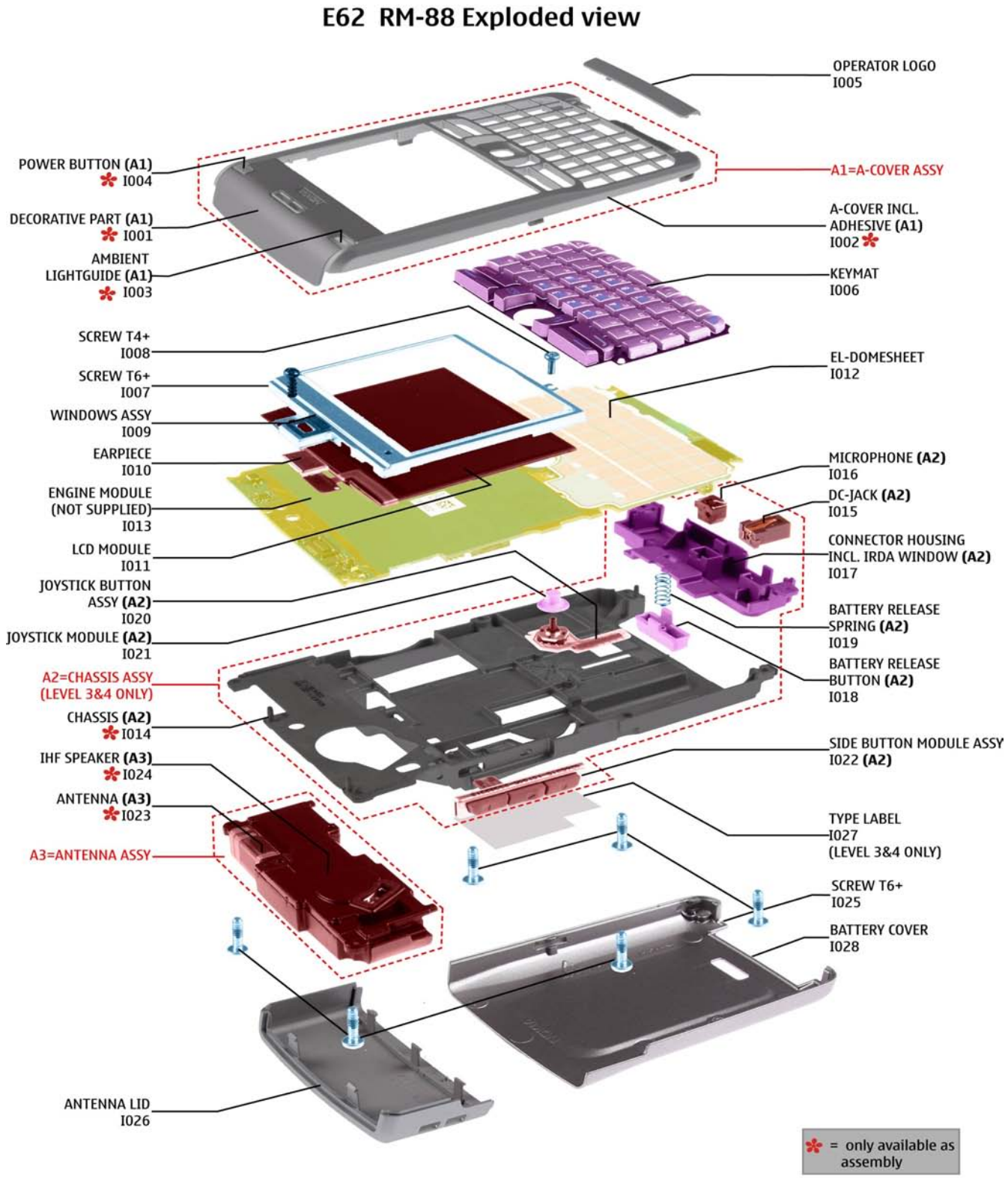

Figure 2 Exploded view of RM-88

Parts lists

Mechanical spare parts list

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS).
To ensure you are always using the latest codes, please check the PWS on a daily basis.

Bold = ASSY
"XXXXXXX" = VARIANTS
"-" = NOT AVAILABLE
"???????" = AVAILABLE AS SPARE PART
I0xx = ITEM codes for upper or mono block
I1xx = ITEM codes for hinge block
I2xx = ITEM codes for lower block
I3xx = ITEM codes for soldered spare parts on the upper, hinge or lower block and not exchangable

ITEM/ CIRCUIT REF.	PART NO	PART NAME	QTY
I009	**???????**	**Window Assembly 040-012649**	**1**
A1	**???????**	**A-Cover Assembly Silver 040-012429**	**1**
I026	???????	SCREW M1.6X5.7 DMD12402 TORX SILV	6
I008	???????	SCREW M1.4X3.4 TORX PLUS 4IP	1
I007	???????	Remform screw 1.8x8	1
I019	???????	Battery Release Spring	1
I028	???????	BLANK LABEL 29mmx18mm EXP65673	1
I021	???????	Joystick Button 040-012658	1
I018	???????	Battery Release Button 040-012946	1
I023	???????	Joystick module tape 040-020164	1
I005	XXXXXXX	Operator Logo painted Silver 040-012438	1
I027	XXXXXXX	Antenna Lid, painted Silver 040-012654	1
I029	???????	Battery Cover painted 040-012428 Silver	1
I012	???????	EL-Dome Sheet 040-012655	1
I006	XXXXXXX	KEYMAT PRINTED SILVER 040-021863 EN-NL	1
I020	**???????**	**1RE JOYSTICK ASSEMBLY**	**1**
A2	**???????**	**Chassis Assembly 040-012635**	**1**
I017	**???????**	**CONNECTOR HOUSING ASSEMBLY 040-015883**	**1**
I022	**???????**	**Side Button Module 040-012642**	**1**
I011	???????	LCD AM 320x240 COG 16MCo Oxford	1

ITEM/ CIRCUIT REF.	PART NO	PART NAME	QTY
I016	???????	MIC MOD+HOLDER TOMAHAWK -42+-3DB	1
I010	???????	EARPIECE+SPRING 22+/-3DB 32R 7X11	1
I015	???????	CONN CHR DIA 2.0MM COMPRESS	1
A3	???????	ANTENNA MOD GSM/WCDMA P2524	1

RM-88 component parts list

Component parts list (1qr_10a_asmmtx)

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS).
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Item	Side	Grid reference		Description and value			
A2400	Bottom	C	8	SHIELD_040_015795	PWB POWER SHIELD CAN	~	~
A2801	Bottom	C	13	SHIELD_PWB_CAN_RAP	SHIELD PWB CAN RAP	~	~
A4801	Bottom	K	10	SHIELD_040_017960	PWB CAN COMBO	~	~
A4802	Bottom	L	7	SHIELD_PWB_CAN_APE	SHIELD PWB CAN APE	~	~
A6001	Bottom	L	4	SHIELD_PWB_CAN_WCDMA	SHIELD PWB CAN WCDMA	~	~
A7506	Bottom	G	16	SHIELD_PWB_CAN_PA	SHIELD PWB CAN Pa	~	~
A7507	Bottom	G	13	SHIELD_PWB_CAN_PIHI	SHIELD PWB CAN PIHI	~	~
B2200	Bottom	C	10	CRYSTAL_3.3X1.6_H0.9	CRYSTAL 32.768KHZ +-30PPM 12.5PF	32.768kHz	~
C2000	Bottom	D	5	0402C	Chipcap 5% NP0	27p	50V
C2001	Bottom	D	5	0603C_H0.95	CHIPCAP X5R 1U K 25V 0603	1u0	25V
C2002	Bottom	E	4	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2003	Bottom	E	4	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V

Item	Side	Grid reference		Description and value			
C2004	Bottom	E	4	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C2006	Bottom	E	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2025	Bottom	F	4	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3
C2026	Bottom	F	4	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3
C2027	Bottom	F	3	0402C	Chipcap 5% X7R	3n3	50V
C2028	Bottom	F	3	0402C	Chipcap 5% NP0	47p	50V
C2029	Bottom	F	3	0402C	Chipcap 5% X7R	3n3	50V
C2030	Bottom	H	3	0402C	Chipcap 5% X7R	270p	50V
C2031	Bottom	F	3	0402C	Chipcap 5% NP0	47p	50V
C2071	Bottom	K	18	TANT_C_6.2 X3.4_H1.7	CHIPTCAP 150U M 10V 6X3.2X1.5	150u_10V	10V
C2100	Bottom	G	3	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C2101	Bottom	G	3	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C2102	Bottom	G	3	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2103	Top	F	22	0402C	Chipcap 5% X7R	1n0	50V
C2104	Top	F	22	0402C	Chipcap 5% X7R	1n0	50V
C2200	Bottom	B	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2201	Bottom	D	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2202	Bottom	E	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V

Item	Side	Grid reference		Description and value			
C2203	Bottom	C	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2204	Bottom	C	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2205	Bottom	B	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2206	Bottom	C	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2207	Bottom	D	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2208	Bottom	C	10	0402C	Chipcap 5% NP0	27p	50V
C2209	Bottom	C	10	0402C	Chipcap 5% NP0	22p	50V
C2210	Bottom	D	7	0603C	CHIPCAP X5R 1U K 16V 0603	1u0	16V
C2211	Bottom	D	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2212	Bottom	C	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2213	Bottom	D	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2214	Bottom	D	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2215	Bottom	E	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2216	Bottom	E	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2217	Bottom	D	10	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2218	Bottom	C	9	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2219	Bottom	D	10	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2220	Bottom	C	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2221	Bottom	E	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2222	Bottom	D	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid reference		Description and value			
C2223	Bottom	B	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2224	Bottom	B	9	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2225	Bottom	D	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2226	Bottom	D	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2227	Bottom	C	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2228	Bottom	D	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2229	Bottom	C	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2230	Bottom	D	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2231	Bottom	B	8	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3
C2232	Bottom	D	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2270	Bottom	B	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2271	Bottom	B	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2272	Bottom	B	9	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2273	Bottom	C	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2274	Bottom	C	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2275	Bottom	B	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2281	Bottom	E	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2300	Bottom	C	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2301	Bottom	B	6	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3

Item	Side	Grid reference		Description and value			
C2302	Bottom	B	7	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2303	Bottom	D	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2304	Bottom	C	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2305	Bottom	E	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2306	Bottom	C	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2307	Bottom	C	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2309	Bottom	B	5	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2312	Bottom	C	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2313	Bottom	D	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2314	Bottom	D	6	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2315	Bottom	E	7	0603C_H0.95	CHIPCAP X5R 1U K 25V 0603	1u0	25V
C2316	Bottom	E	7	0402C	Chipcap 5% NP0	56p	50V
C2317	Bottom	D	7	0402C	Chipcap 5% NP0	27p	50V
C2319	Bottom	E	7	0603C_H0.95	CHIPCAP X5R 1U K 25V 0603	1u0	25V
C2700	Bottom	D	16	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2800	Bottom	I	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2801	Bottom	L	10	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2802	Bottom	I	10	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid reference		Description and value			
C2803	Bottom	I	10	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2804	Bottom	I	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2805	Bottom	L	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2807	Bottom	L	10	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2808	Bottom	I	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2809	Bottom	I	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2810	Bottom	I	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2811	Bottom	L	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2812	Bottom	I	10	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2813	Bottom	L	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2814	Bottom	I	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2815	Bottom	K	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2818	Bottom	J	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2819	Bottom	L	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2820	Bottom	I	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid reference		Description and value			
C2830	Bottom	L	11	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C3000	Bottom	K	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3001	Bottom	J	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3002	Bottom	J	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3003	Bottom	J	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3004	Bottom	J	6	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3005	Bottom	M	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3006	Bottom	L	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3007	Bottom	M	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3008	Bottom	J	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3009	Bottom	M	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3010	Bottom	J	12	0402C	Chipcap +-0.25pF NP0	3p3	50V
C3011	Bottom	J	6	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3017	Bottom	L	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3018	Bottom	M	6	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3100	Bottom	G	6	0402C	CHIPCAP NP0 27P J 50V 0402	27p0	50V

Item	Side	Grid reference		Description and value			
C4400	Top	C	22	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4401	Top	C	22	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4402	Top	C	22	0402C	Chipcap 5% NP0	27p	50V
C4403	Top	C	22	0402C	Chipcap 5% NP0	27p	50V
C4404	Bottom	I	4	0402C	Chipcap 5% NP0	68p	50V
C4405	Bottom	I	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C4408	Bottom	H	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4409	Bottom	I	2	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C4410	Bottom	H	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4411	Bottom	I	2	0402C	Chipcap 5% NP0	27p	50V
C4414	Bottom	I	5	0603C	CHIPCAP X5R 1U K 16V 0603	1u0	16V
C4420	Bottom	B	13	0402C	Chipcap X7R 5% 16V 0402	10n	16V
C4421	Bottom	B	13	0402C	Chipcap X7R 5% 16V 0402	10n	16V
C4424	Bottom	I	5	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C5200	Bottom	L	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5201	Bottom	M	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C5202	Bottom	L	11	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C5203	Bottom	M	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid reference		Description and value			
C5204	Bottom	L	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6031	Bottom	K	3	0402C	Chipcap 5% NP0	18p	50V
C6032	Bottom	L	3	0402C	Chipcap 5% NP0	100p	50V
C6033	Bottom	L	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6034	Bottom	L	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6035	Bottom	L	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6036	Bottom	L	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6037	Bottom	L	4	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6038	Bottom	K	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6039	Bottom	J	4	0402C	Chipcap 5% NP0	18p	50V
C6041	Bottom	K	3	0402C	Chipcap +-0.25pF NP0	2p7	50V
C6042	Bottom	K	4	0402C	Chipcap +-0.25pF NP0	2p7	50V
C6050	Bottom	K	3	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C7501	Bottom	H	13	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7503	Bottom	F	12	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7504	Bottom	H	13	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7505	Bottom	F	12	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C7506	Bottom	F	12	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7507	Bottom	F	12	0402C	Chipcap X7R 5% 16V 0402	10n	16V
C7508	Bottom	F	13	0402C	Chipcap 5% NP0	18p	50V

Item	Side	Grid reference		Description and value			
C7509	Bottom	F	12	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7510	Bottom	F	13	0402C	Chipcap 5% NP0	27p	50V
C7511	Bottom	G	12	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7512	Bottom	G	11	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7513	Bottom	F	12	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7515	Bottom	H	12	0402C	Chipcap +-0.25pF NP0	3p3	50V
C7516	Bottom	G	12	0402C	Chipcap 5% X7R	470p	50V
C7517	Bottom	G	12	0402C	Chipcap +-0.25pF NP0	3p3	50V
C7518	Bottom	F	13	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C7520	Bottom	H	16	0402C	Chipcap +-0.25pF NP0	3p3	50V
C7522	Bottom	F	16	0402C	Chipcap +-0.25pF NP0	1p8	50V
C7523	Bottom	H	16	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C7524	Bottom	F	15	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C7525	Bottom	F	17	0402C	Chipcap 5% NP0	18p	50V
C7530	Bottom	M	4	0402C	Chipcap X7R 10% 25V 0402	4n7	25V
C7590	Bottom	L	3	0402C	Chipcap X7R 5% 16V 0402	10n	16V
C7591	Top	K	22	0402C	Chipcap 5% NP0	100p	50V
C7593	Top	J	22	0402C	Chipcap +-0.25pF NP0	8p2	50V
C7594	Top	J	23	0402C	Chipcap 5% NP0	12p	50V
C7595	Top	J	22	0402C	Chipcap 5% NP0	12p	50V

Item	Side	Grid reference		Description and value			
C7596	Top	K	23	0402C	Chipcap 5% NP0	100p	50V
C7597	Bottom	M	3	0402C	Chipcap 5% NP0	100p	50V
D2200	Bottom	C	8	TFBGA_108	RETU 3.02 TSA1GJWE TFBGA108	~	~
D2800	Bottom	K	10	uBGA_289	RAPGSM V1.1 PA uBGA289	~	~
D3000	Bottom	L	7	FBGA133_11.6X13.1	COMBO 256MNOR +1GM3 +256MDDRSDRAM FBGA133	8Mx16/16Mx16/8Mx16	~
D4400	Bottom	C	13	LLP_44	MCU E 8BIT COP8TAB5HYQ8 LLP44	~	~
F2000	Bottom	C	4	0603_FUSE_AVX2MATS	SM FUSE F 2.0A 32V	2A	~
G2200	Bottom	B	12	BATTER_EECEP	RTC BACUP CAPAC 311 SIZE FOR 2.6V 4UAH	2.6V	~
G7500	Bottom	H	12	VCO_DCS02733	VCO 3296-3980MHZ 4-BAND MATSUSHITA	3296-3980 MHz	~
G7501	Bottom	F	11	NKG3176B_H1.0	VCTCXO 38.4MHZ 2.5V	38.4MHz	~
L2000	Bottom	D	4	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~
L2100	Top	F	23	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2102	Bottom	B	20	COIL_0603CS	CHIP COIL 56N J Q38/250MHZ 0603	56nH	~
L2103	Bottom	B	20	COIL_0603CS	CHIP COIL 56N J Q38/250MHZ 0603	56nH	~
L2202	Bottom	E	9	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~

Item	Side	Grid reference		Description and value			
L2203	Bottom	E	9	FERRITE_0402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2204	Bottom	E	9	FERRITE_0402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2205	Bottom	E	9	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2206	Bottom	E	8	FERRITE_0402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2270	Bottom	B	8	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2271	Bottom	B	8	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2272	Bottom	C	8	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2273	Bottom	B	8	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2301	Bottom	B	5	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2302	Bottom	B	6	CHOKE_SER400_H1.2	INDUCT WW 10UH 0A65 0R35 4X4X1.2	10uH	~
L2304	Bottom	D	6	CHOKE_SER300	CHOKE 22U M 1R5 0.35A	22uH	~
L2305	Bottom	D	5	FERRITE_0402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2306	Bottom	C	5	FERRITE_0402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L4400	Top	C	22	FERRITE_0402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L4401	Top	C	22	FERRITE_0402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~

Item	Side	Grid reference		Description and value			
L4402	Bottom	I	5	CHOKE_ELT3 KN152C	COIL 0.47MH 50MA 3.3X3.4X1.4M M	0.47MH	~
L5200	Bottom	L	12	FERRITE_04 02	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L6030	Bottom	K	3	0402L	CHIP COIL 2N7 +-0N3 Q29/800M 0402	2n7H	~
L6031	Bottom	K	4	0402L	CHIP COIL 2N7 +-0N3 Q29/800M 0402	2n7H	~
L6032	Bottom	K	4	0402L	CHIP COIL 22N J Q28/800M 0402	22nH	~
L7500	Bottom	G	14	0402L	CHIP COIL 18N J Q29/800M 0402	18nH	~
L7501	Bottom	G	14	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~
L7502	Bottom	F	13	FERRITE_04 02	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L7503	Bottom	F	16	0402LQW	CHIP COIL 27N C Q25/250MHZ 0402	27nH	~
L7504	Bottom	G	14	0402L	CHIP COIL 47N J Q23/800M 0402	47nH	~
L7505	Bottom	G	14	0402L	CHIP COIL 22N J Q28/800M 0402	22nH	~
L7515	Bottom	H	12	0402L_H0.4 5	CHIP COIL 4N7 +-0N1 Q29/1GHZ 0402	4n7H	~
L7530	Bottom	H	14	0402L	FERR.BEAD 240R7100M 0.4A 0R4 0402	240R/ 100MHz	~

Item	Side	Grid reference		Description and value			
L7531	Bottom	F	14	0402L	FERR.BEAD 240R7100M 0.4A 0R4 0402	240R/ 100MHz	~
L7591	Top	J	22	0402L	CHIP COIL 6N8 J Q27/800M 0402	6n8H	~
L7592	Top	K	23	0402L_POL2	CHIP COIL 82N +-0N3 Q17/300M 0402	82nH	~
M2100	Bottom	C	4	VIBRA_M_KH N4NX1RA	SMD VIBRA MOTOR 1.3V 90MA 9000RPM	~	~
N2300	Bottom	C	6	TFBGA_84_6 .15X6.15	TAHVO V5.2 LF TFBGA84	~	~
N2301	Bottom	E	6	USMD8_1.69 X1.69	WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8	~	~
N4401	Bottom	H	2	IRDA_RPM9 60	IRDA 1.15MBPS 2.2MM ROHS	~	~
N4402	Bottom	H	4	MSOP_10	EL DRIVER D381B 2-7V MSOP-10	~	~
N4403	Bottom	E	13	SC70_5	1XOP AMP 2.7-5.5V LMV321 SC70-5	~	~
N5200	Bottom	M	11	USMD16_2.0 3X2.03	VREG & LEVEL SHIFT LP3928 USMD16	~	2.8V
N6030	Bottom	L	4	CSP_47_3.85 X4.05	BC4-ROM1.0RDL	~	~
N7505	Bottom	G	13	TFBGA144	AHNE301A TRANCEIVER RFIC TFBGA144	~	~
N7520	Bottom	G	16	RF9282E3.6	PA RF9282E6.3 GSM/EDGE 850/900/1800 /1900	~	~
N7590	Top	J	22	SC70_6_FAIR	HIGH POWER SPDT RF SW SC70	~	~

Item	Side	Grid reference		Description and value			
R2000	Bottom	E	4	0402R	Resistor 5% 63mW	220R	~
R2001	Bottom	E	4	FLIP_CHIP_8_1.7X1.7	ASIP SINGLE ENDED MICROPHONE INTERF BGA8	~	~
R2003	Bottom	G	4	0402R	Chipres 0W06 22k F 200ppm 0402	22k	~
R2004	Bottom	G	4	0402R	Chipres 0W06 22k F 200ppm 0402	22k	~
R2006	Bottom	F	3	BGA11	ASIP 4 LINES AUDIO FILTER BGA11	~	~
R2007	Bottom	I	3	uBGA11_1.6X2.15	ASIP SILIC USB OTG / ESD BGA11	~	~
R2008	Bottom	I	3	0404_RP	RES NETWORK 0W06 220K/ 120K J 0404	220k/120k	~
R2015	Bottom	D	4	BGA4_1.01X1.07	ASIP TVS BGA4	~	~
R2025	Bottom	F	4	0402R	Resistor 5% 63mW	10R	~
R2026	Bottom	F	4	0402R	Resistor 5% 63mW	10R	~
R2030	Bottom	I	3	0402R	Resistor 5% 63mW	100R	~
R2070	Bottom	K	18	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2071	Bottom	C	10	0402_NTH5	NTC RES 47K J B=4050+-3% 0402	47k	~
R2100	Bottom	G	3	FLIP_CHIP_8_1.7X1.7	ASIP SINGLE ENDED MICROPHONE INTERF BGA8	~	~
R2101	Bottom	G	3	0402R	Resistor 5% 63mW	220R	~
R2104	Top	F	23	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~

Item	Side	Grid reference		Description and value			
R2105	Top	F	23	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2106	Bottom	C	17	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2107	Bottom	C	17	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2108	Top	F	22	0402R	Chipres 0W06 jumper 0402	0R	~
R2109	Top	F	22	0402R	Chipres 0W06 jumper 0402	0R	~
R2200	Bottom	E	10	0402R	Resistor 5% 63mW	100k	~
R2201	Bottom	D	10	0402R	Resistor 5% 63mW	120k	~
R2206	Bottom	B	9	0402R	Resistor 5% 63mW	1k0	~
R2207	Bottom	B	10	0402R	Resistor 5% 63mW	1k0	~
R2208	Bottom	B	10	0402R	Resistor 5% 63mW	1k0	~
R2209	Bottom	B	10	0402R	Resistor 5% 63mW	1k0	~
R2212	Bottom	B	9	0402R	Resistor 5% 63mW	470R	~
R2213	Bottom	D	10	0402R	Resistor 5% 63mW	4k7	~
R2214	Bottom	E	10	0402R	Resistor 5% 63mW	4k7	~
R2216	Bottom	D	10	0402R	CHIPRES 0W06 2M2 J 0402	2M2	~
R2307	Bottom	C	5	0402R	Resistor 5% 63mW	100R	~
R2310	Bottom	D	7	0402R	Resistor 5% 63mW	33R	~
R2700	Bottom	D	16	uBGA8_1.47 X1.47	ASIP SIM INTERFACE **LOW CAP**BGA8	~	~

Item	Side	Grid reference		Description and value			
R3000	Bottom	K	8	0402R	Resistor 5% 63mW	4k7	~
R3002	Bottom	I	10	0402R	Resistor 5% 63mW	10R	~
R3003	Bottom	K	8	0402R	Resistor 5% 63mW	4k7	~
R3004	Bottom	K	8	0402R	Resistor 5% 63mW	4k7	~
R3007	Bottom	M	8	0402R	Resistor 5% 63mW	10k	~
R3008	Bottom	L	8	0402R	CHIPRES 0W06 20R J 0402	20R	~
R4400	Top	B	22	0402R	Resistor 5% 63mW	470k	~
R4401	Top	B	22	0402R	Resistor 5% 63mW	100k	~
R4402	Top	B	22	0402R	Resistor 5% 63mW	470k	~
R4403	Top	A	22	0402_NTH5	NTC RES 47K J B=4050+-3% 0402	47k	~
R4404	Bottom	I	5	0402R	Chipres 0W06 jumper 0402	0R	~
R4406	Top	L	22	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4407	Bottom	D	13	0402R	Resistor 5% 63mW	18R	~
R4409	Bottom	D	13	0402R	Resistor 5% 63mW	18R	~
R4410	Bottom	D	14	0402R	Resistor 5% 63mW	1k0	~
R4412	Top	B	22	0402R	Resistor 5% 63mW	680R	~
R4413	Top	C	22	0402R	Chipres 0W06 jumper 0402	0R	~
R4414	Bottom	G	4	0402R	Resistor 5% 63mW	100k	~
R4423	Bottom	I	2	0805R_THERM1	CHIPRES 0W125 4R7 J 0805	4R7	~

Item	Side	Grid reference		Description and value			
R4430	Bottom	B	14	0402R	Resistor 5% 63mW	100k	~
R4432	Bottom	D	11	0402R	Chipres 0W06 jumper 0402	0R	~
R4438	Bottom	D	14	0402R	Resistor 5% 63mW	3k3	~
R4439	Bottom	D	14	0402R	Resistor 5% 63mW	3k3	~
R4440	Bottom	D	14	0402R	Resistor 5% 63mW	3k3	~
R4441	Bottom	H	3	0402R	Resistor 5% 63mW	82k	~
R4444	Bottom	I	5	0402R	Chipres 0W06 5% 0402	3M3	~
R4506	Bottom	B	17	0402R	Chipres 0W06 jumper 0402	0R	~
R4507	Bottom	B	17	0402R	Chipres 0W06 jumper 0402	0R	~
R4508	Bottom	B	17	0402R	Chipres 0W06 jumper 0402	0R	~
R4509	Bottom	B	16	0402R	Chipres 0W06 jumper 0402	0R	~
R5201	Bottom	M	10	0402R	Resistor 5% 63mW	100k	~
R5202	Bottom	L	10	0402R	Resistor 5% 63mW	100k	~
R5203	Bottom	M	11	0402R	Resistor 5% 63mW	100k	~
R5204	Bottom	L	11	0402R	Resistor 5% 63mW	2k2	~
R6030	Bottom	L	3	0402R	Resistor 5% 63mW	10k	~
R6031	Bottom	K	4	0402R	Resistor 5% 63mW	10k	~
R6032	Bottom	L	4	0402R	CHIPRES 0W06 2R2 J 0402	2R2	~
R6034	Bottom	K	3	0402R	Resistor 5% 63mW	10k	~
R6035	Bottom	K	4	0402R	Resistor 5% 63mW	100k	~

Item	Side	Grid reference		Description and value			
R6302	Bottom	H	1	0402R	Chipres 0W06 jumper 0402	0R	~
R7501	Bottom	G	12	0402R	Resistor 5% 63mW	2k2	~
R7502	Bottom	H	13	0402R	CHIPRES 0W06 10K F 0402	10k	~
R7503	Bottom	F	13	0402R	Resistor 5% 63mW	4k7	~
R7504	Bottom	F	12	0402R	Chipres 0W06 jumper 0402	0R	~
R7505	Bottom	G	12	0402R	CHIPRES 0W06 8K2 F 0402	8k2	~
R7506	Bottom	F	13	0402R	Resistor 5% 63mW	10R	~
R7507	Bottom	H	13	0402R	Resistor 5% 63mW	10R	~
R7508	Bottom	F	12	0402R	Resistor 5% 63mW	10R	~
R7509	Bottom	F	12	0402R	Resistor 5% 63mW	22k	~
R7510	Bottom	F	17	0402R	Resistor 5% 63mW	15R	~
R7522	Bottom	F	16	0402R	CHIPRES 0W06 27K F 0402	27k	~
R7523	Bottom	H	16	0402R	Chipres 0W06 jumper 0402	0R	~
R7586	Bottom	L	4	0402R	Resistor 5% 63mW	330R	~
R7587	Bottom	M	3	0402R	Chipres 0W06 jumper 0402	0R	~
R7588	Top	J	23	0402R	Chipres 0W06 jumper 0402	0R	~
R7590	Bottom	M	4	0402R	Resistor 5% 63mW	1k8	~
R7591	Top	J	22	0402R	Chipres 0W06 jumper 0402	0R	~
R7592	Bottom	L	4	0402R	Resistor 5% 63mW	27k	~
R7594	Bottom	M	3	0402R	Resistor 5% 63mW	1k2	~

Item	Side	Grid reference		Description and value			
S4401	Top	L	22	BUTTON_EVPAA	SWITCH PB LIGHT EVPAA 15V 20MA	~	~
T7501	Bottom	G	12	TRANS_LDB15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
T7520	Bottom	H	17	TRANS_LDB15	TRANSF BALUN 1800 +-100mhz 2x1.25	~	~
V2302	Bottom	B	5	SOD323F	SCH DI 30V 2A SOD323F	~	~
V4400	Top	B	22	PT202MR0MP	DI PHOTO PT202MR0MP 620NM 1.25X2	~	~
V4401	Bottom	I	4	SC_76	DI ZEN 100V 6% 200MW SOD323	~	~
V4402	Bottom	J	4	SC_76	DI ZEN 100V 6% 200MW SOD323	~	~
V4403	Bottom	E	14	VMT3	TR 2SC5658QRS N 50V 0A1 0W15 VMT3	~	~
V4404	Bottom	H	4	SOT_666	TRX2+RX4 PEMD9 N&P 10K/47K 0W12 SOT666	~	~
V4405	Top	B	22	LED_CL191	LED CL-191WB-D-T WHITE 0` 115MCD 0603	~	~
V4406	Top	B	22	EM3	TR PDTC114EEN 50V RB=RBE=10K EM3	~	~
V4407	Bottom	B	14	EM3	TR PDTC114EEN 50V RB=RBE=10K EM3	~	~
V7590	Bottom	M	3	SOT323	Tr NPN 12V 35mA SOT323	~	~

Item	Side	Grid reference		Description and value			
W6300	Bottom	G	1	ANT_RENM05041	BT/WLAN 1.0 TP ANTENNA RELEASE	~	~
X2000	Bottom	C	1	CON_JACK_HR33NK_2DJA_2S	CONN DC-JACK 2.0MM 3POL SPR 90DEG	~	~
X2001	Bottom	K	2	USB_MITSUMI_R415082	SMD CONN 5POL MINI-USB B TYPE P0.8	~	~
X2002	Bottom	E	2	JACK_T_378840_A9	HEADSET JACK 4-POLE	~	~
X2070	Bottom	I	18	LYNX_BATT_CONN_H7.0	SM BATTERY CONN 3POL SPR 12V 2A	~	~
X2100	Bottom	D	20	CONN_ANT_DMD11562	CON PPP ANTENNA R1024 DMD11562	~	~
X2101	Bottom	D	20	CONN_ANT_DMD11562	CON PPP ANTENNA R1024 DMD11562	~	~
X2701	Bottom	C	15	SIM_CONN_M_SK_200300383	SM SIM CONN 2X3POL P2.54 H4.6	~	~
X4400	Top	E	22	JST_R_JAVK_G_1_R3	SM CONN 2X12F P0.4 30V .3A PWB/PWB	~	~
X4500	Bottom	F	8	CONN_SD_54742_002	SM LCD CONN 1X8 P2.0 SPR 50V 0.5A	~	~
X4501	Bottom	B	17	SMK_4309_B_B_6P_V2	SM CONN 6P SPR P1.3 50V BTOB	~	~
X5200	Bottom	K	15	MINISD_SC1S011V1S3	CONN MINISD PUSH-PUSH 3.3V 0.5A	~	~
X7504	Bottom	M	23	SPRING_WN9149_N10	C-SPRING ANTENNA active	~	~
X7505	Bottom	L	23	SPRING_WN9149_N10	C-SPRING ANTENNA active	~	~

Item	Side	Grid reference		Description and value			
X7507	Bottom	J	23	SPRING_WN9149_N10	C-SPRING ANTENNA active	~	~
Z2001	Bottom	I	3	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
Z2002	Bottom	H	3	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
Z2003	Bottom	F	3	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
Z2004	Bottom	F	3	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
Z2005	Bottom	E	3	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
Z4402	Top	B	23	uBGA25_2.47X2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4403	Top	C	23	uBGA25_2.47X2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4500	Bottom	B	13	uBGA24_2.62X2.62	ASIP EMIF10-1K010F2 **PB-FREE**	~	~
Z4501	Bottom	D	12	uBGA24_2.62X2.62	ASIP EMIF10-1K010F2 **PB-FREE**	~	~
Z5200	Bottom	M	12	uBGA11_1.62X2.12	ASIP EMIF04-MMC02F2**PB-FREE**	~	~
Z6030	Bottom	K	4	EZFVQ42NM61S	LTCC FILT 2441.75 +-41.75MHZ 2.5X2	2441.75MHz	~
Z7501	Bottom	G	15	FILTER_2.1X1.7_10P_H0.6	SAW FILT 1842.5/1960MHZ 2.0X1.6MM	1842.5/1960MHZ	~

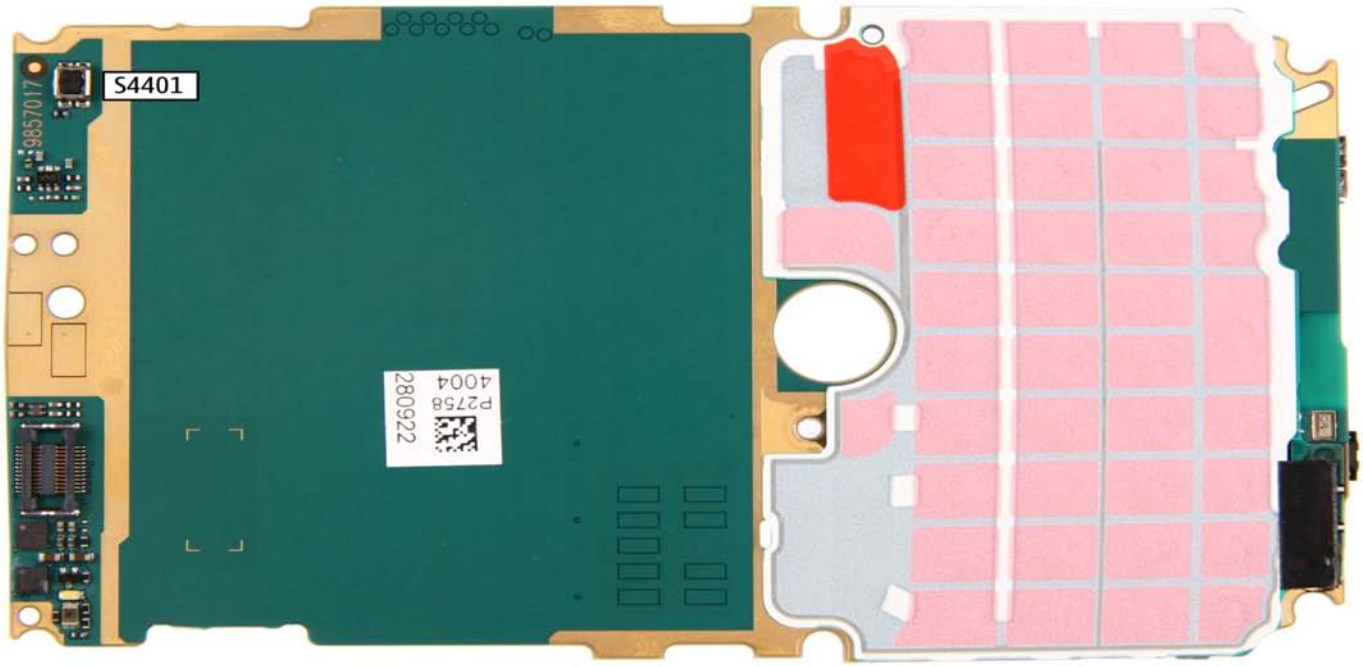
Item	Side	Grid reference		Description and value			
Z7503	Bottom	F	15	MODULE_LMSM43AA_341	TX SAW MODULE GSM 850/900MHZ 4.5X3.2	850/900MHz	~
Z7504	Bottom	G	15	FILTER_2.1X1.7_10P_H0.65	DUAL RX SAW FILTER 850/900MHZ 2016	850/900MHz	~
Z7520	Bottom	H	16	FERRITE_FBMJ1608	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/100MHz	~

Component layouts

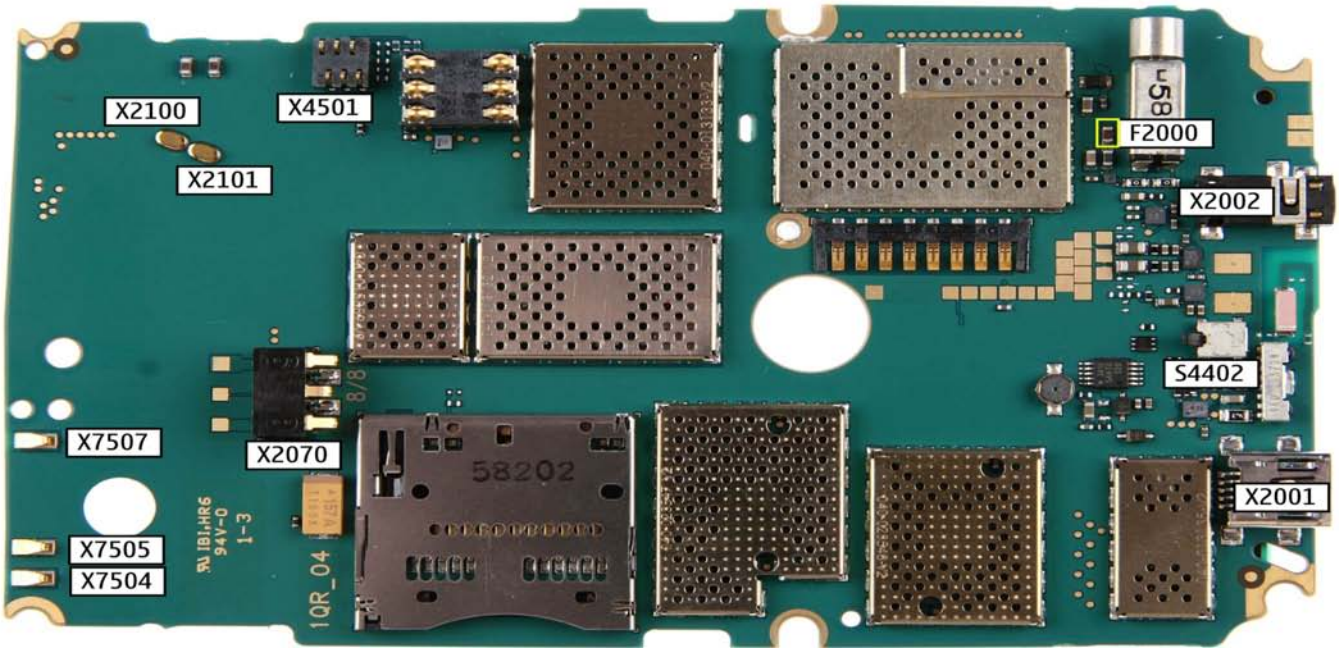
Components overview

E62 RM-88 Components overview

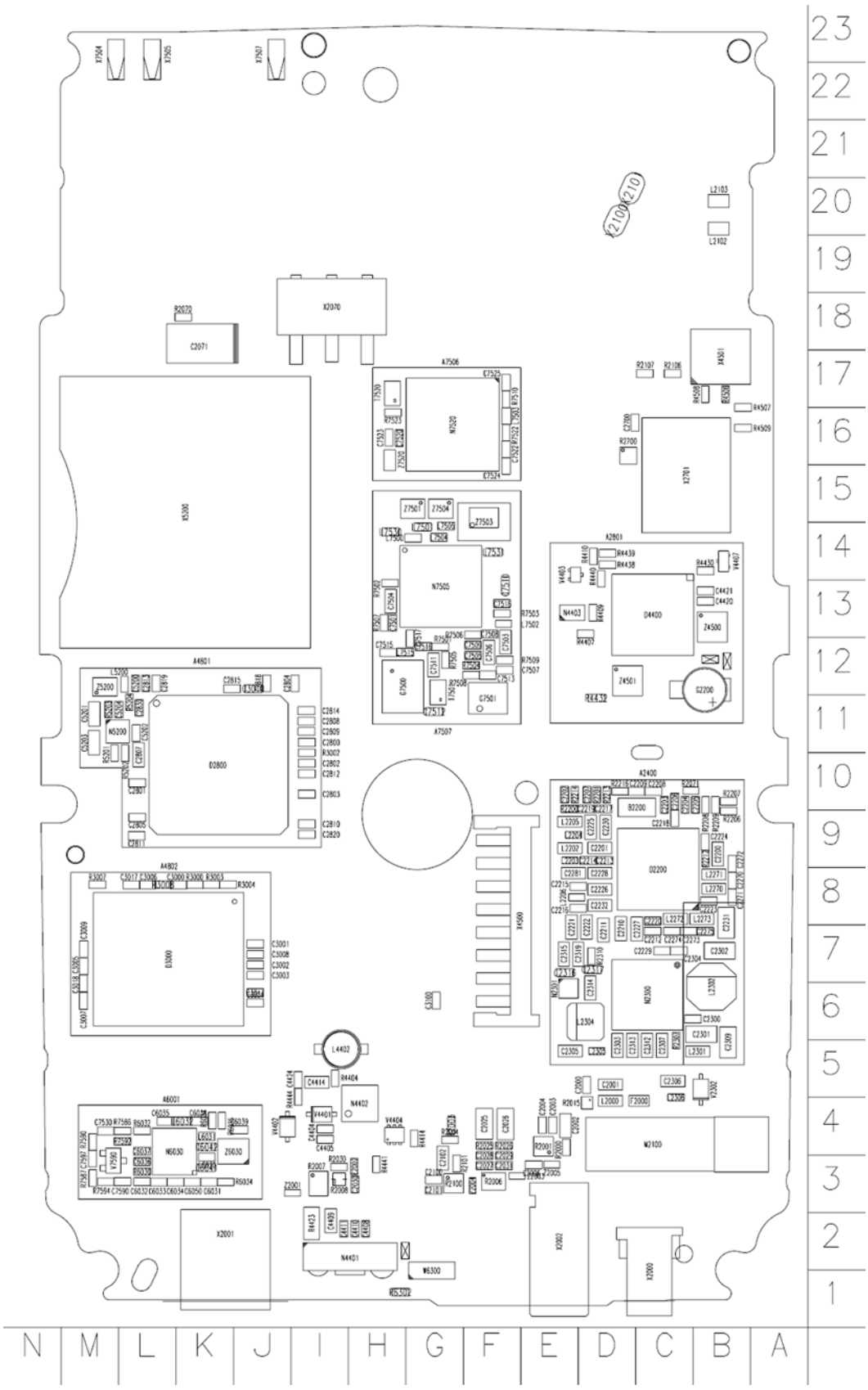
ENGINE MODULE TOP



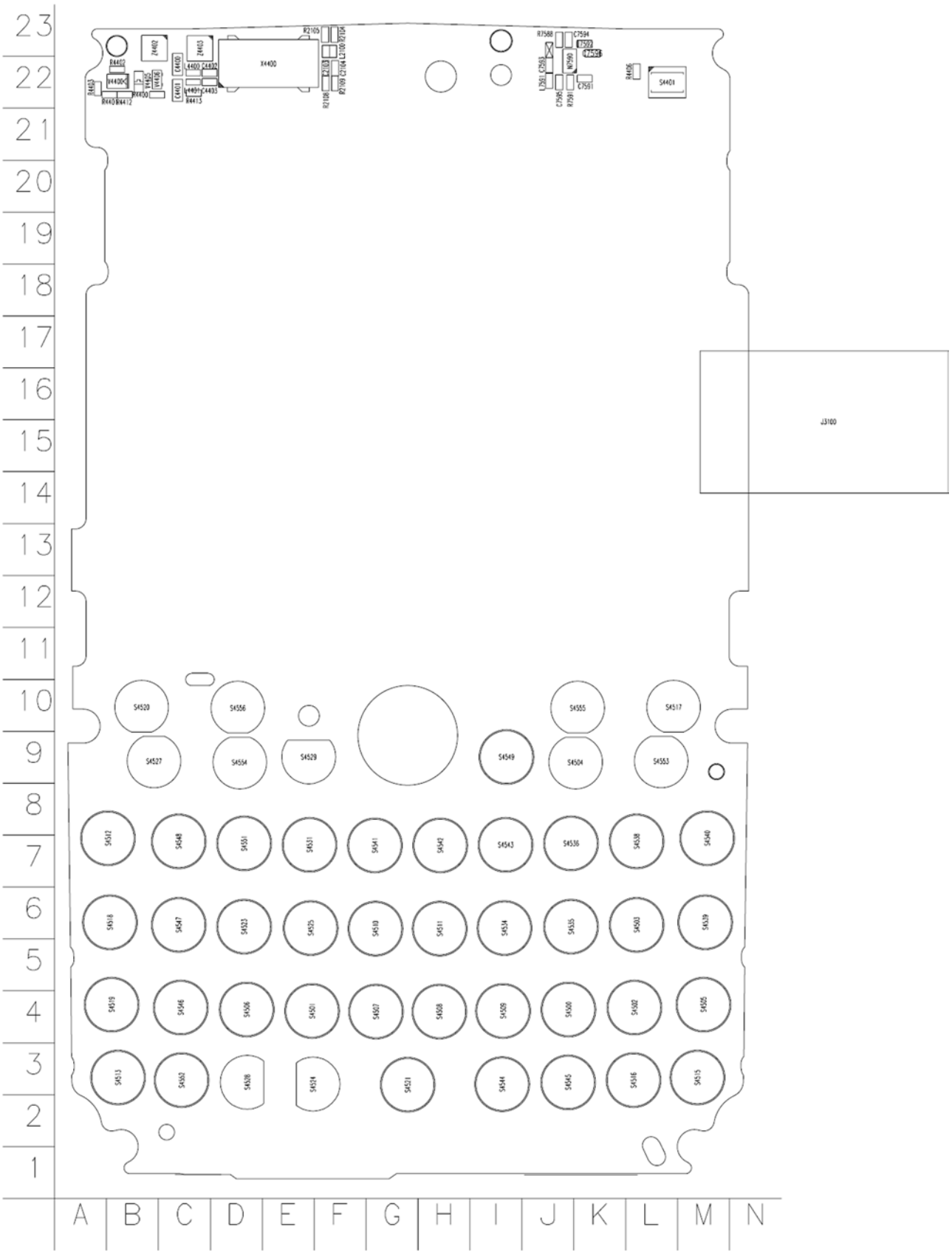
ENGINE MODULE BOTTOM



Component layout - bottom (1qr_10a_asmdrw_b)



Component layout - top (1qr_10a_asmdrw_t)



3 — Service Software Instructions

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Table of Contents

List of Figures

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Phoenix installation steps in brief

Prerequisites

Recommended hardware requirements:

- Computer processor: Pentium 700 MHz or higher
- RAM 256 MB
- Disk space 100-300 MB

Supported operating systems:

- *Windows 2000* Service Pack 3 or higher
- *Windows XP* Service Pack 1 or higher

Context

Phoenix is a service software for reprogramming, testing and tuning phones.

Phoenix installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - PKD-1 (DK2) dongle
  - DKE-2 USB cable

    Note: Separate installation packages for flash update files and drivers are also available, but it is not necessary to use them unless there are updates between *Phoenix* service software releases. If separate update packages are used, they should be used after *Phoenix* and data packages have been installed.

The phone model specific data package includes all changing product specific data:

- Product software binary files
- Files for type label printing
- Validation file for the faultlog repair data reporting system
- All product specific configuration files for *Phoenix* software components

  Note: *Phoenix* and phone data packages should only be used as complete installation packages. Uninstallation should be made from the *Windows* Control Panel.

To use *Phoenix*, you need to:

Steps

1. Connect a PKD-1 (DK2) dongle to the computer parallel port.
2. Install *Phoenix*.
3. Install the phone-specific data package.
4. Configure users.
5. Manage connection settings (depends on the tools you are using).
   - Update FPS-10 software

     Note: There is no need to activate FPS-10.
   - Activate SX-4 smart card, if you need tuning and testing functions.

     Note: When FPS-10 is used only for product software updates, SX-4 smart card is not needed.

Results

Phoenix is ready to be used with FPS-10 flash prommer and other service tools.

Installing *Phoenix*

Prerequisites

- Check that a dongle is attached to the parallel port of your computer.
- Download the *Phoenix* installation package (for example, *phoenix_service_sw_2004_39_x_xx.exe*) to your computer (in *C:|TEMP*, for instance).
- Close all other programs.
- Depending on your operating system, administrator rights may be required to install *Phoenix*.
- If uninstalling or rebooting is needed at any point, you will be prompted by the InstallShield program.

Context

At some point during the installation procedure, you may get the following message:

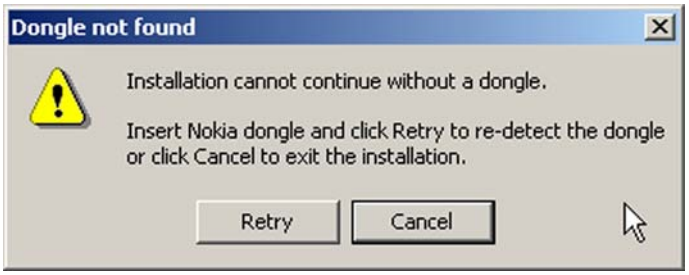


Figure 3 Dongle not found

This may be a result of a defective or too old PKD-1 dongle.

Check the COM/parallel ports used. After correcting the problem, you can restart the installation.

For more detailed information, please refer to *Phoenix* Help files.

> **Tip:** Each feature in *Phoenix* has its own Help function, which can be activated while running the program. Press the **F1** key or the feature's **Help** button to activate a Help file.

Steps

1. To start the installation, run the application file (for example,*phoenix_service_sw_2004_39_x_xx.exe*).
2. In the *Welcome* dialogue, click **Next**.

3. Read the disclaimer text carefully and click **Yes**.

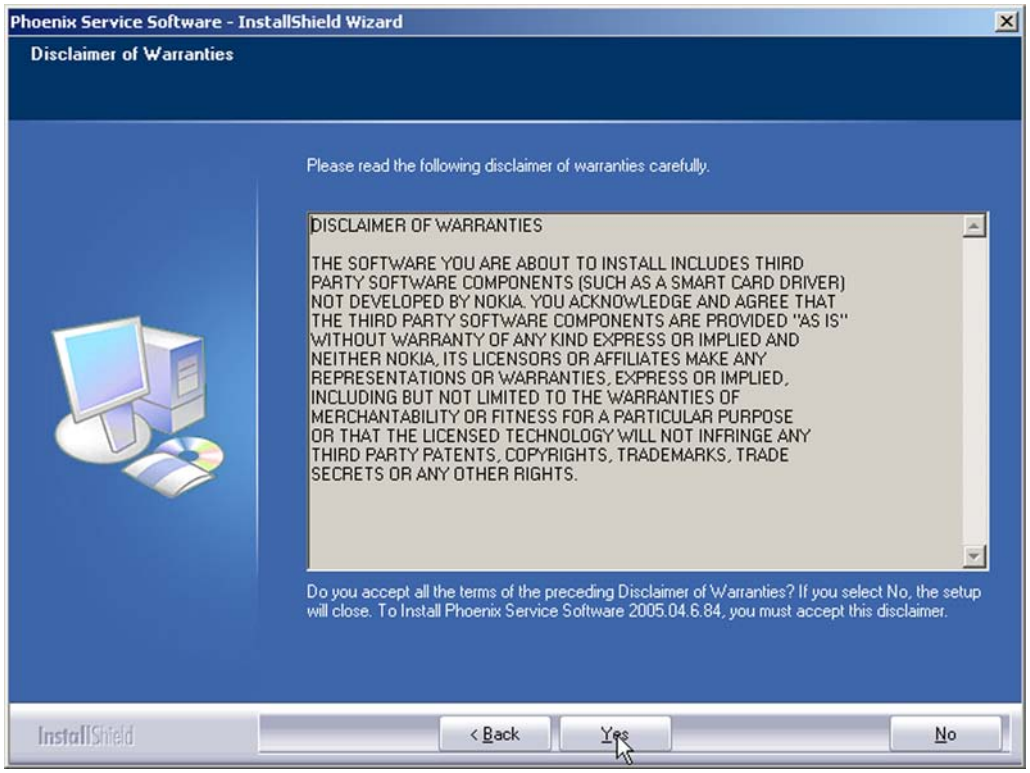


Figure 4 Disclaimer text

4. Choose the destination folder.
   The default folder *C:|ProgramFiles|Nokia|Phoenix* is recommended.
5. To continue, click **Next.**
   To choose another location, click **Browse** (not recommended).
6. Wait for the components to be copied.
   The progress of the installation is shown in the *Setup Status* window.
7. Wait for the drivers to be installed and updated.
   The process may take several minutes to complete.
   If the operating system does not require rebooting, the PC components are registered right away.
   If the operating system requires restarting your computer, the Install Shield Wizard will notifies about it.
   Select **Yes...** to reboot the PC immediately or **No...** to reboot the PC manually afterwards.
   After the reboot, all components are registered.

   Note: *Phoenix* does not work, if the components have not been registered.

8. To end the installation, click **Finish**.

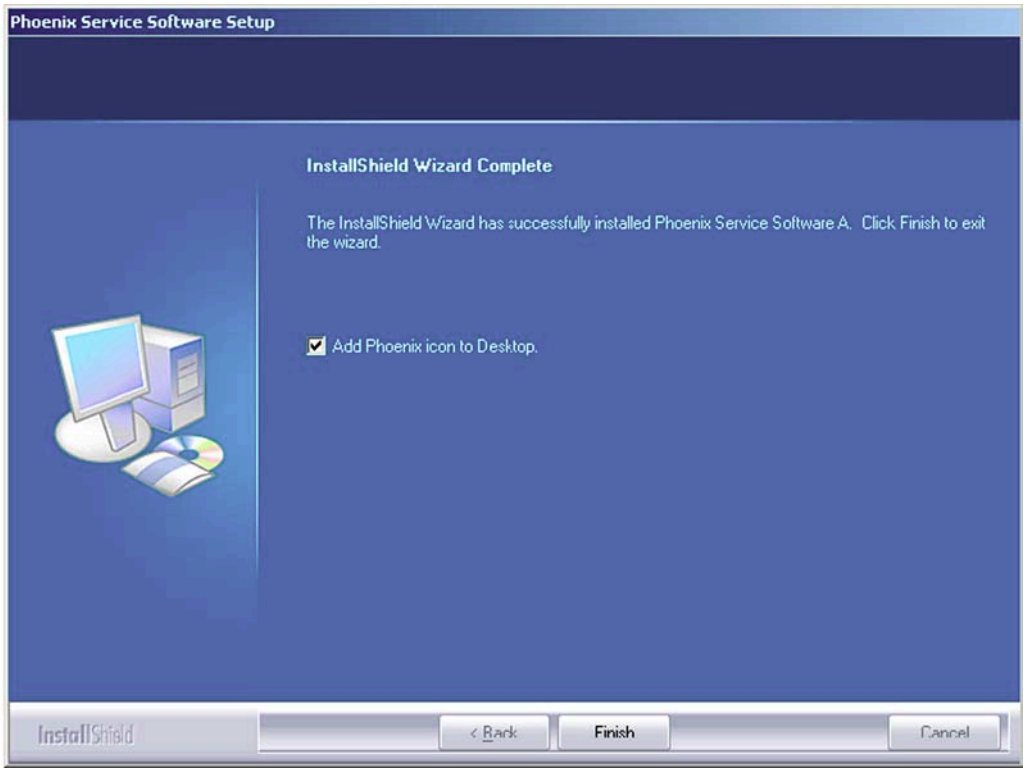


Figure 5 InstallShield Wizard Complete

Next actions

After the installation, *Phoenix* can be used after:

- installing phone model specific data package for *Phoenix*
- configuring users and connections

FPS-10 flash prommer can be used after updating their flash update package files.

Updating *Phoenix* installation

Context

- If you already have the *Phoenix* service software installed on your computer, you need to update the software when new versions are released.
- To update *Phoenix*, you need to follow the same steps as when installing it for the first time.
- When you are updating, for example, from version **a14_2004_16_4_47** to **a15_2004_24_7_55**, the update will take place automatically without uninstallation.
- Always use the latest available versions of both *Phoenix* and the phone-specific data package. Instructions can be found in the phone model specific Technical Bulletins and phone data package *readme.txt* files (shown during installation).
- If you try to update *Phoenix* with the same version you already have (for example, **a15_2004_24_7_55** to **a15_2004_24_7_55**), you are asked if you want to uninstall the existing version. In this case you can choose between a total uninstallation or a repair installation in a similar way when choosing to uninstall the application from the *Windows* Control Panel.
- If you try to install an older version (for example, downgrade from **a15_2004_24_7_55** to **a14_2004_16_4_47**), installation will be interrupted.

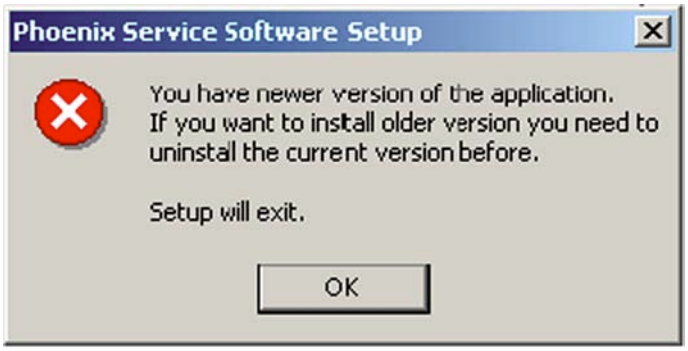


Figure 6 Installation interrupted

- Always follow the instructions on the screen.

Steps

1. Download the installation package to your computer hard disk.
2. Close all other programs.
3. Run the application file (for example, *phoenix_service_sw_2004_39_x_xx.exe*).

Results

A new *Phoenix* version is installed and driver versions are checked and updated.

Uninstalling *Phoenix*

Context

You can uninstall *Phoenix* service software manually from the *Windows* Control Panel.

Steps

1. Open the **Windows Control Panel**, and choose **Add/Remove Programs**.

2. To uninstall *Phoenix*, choose **Phoenix Service Software→Change/Remove→Remove** .

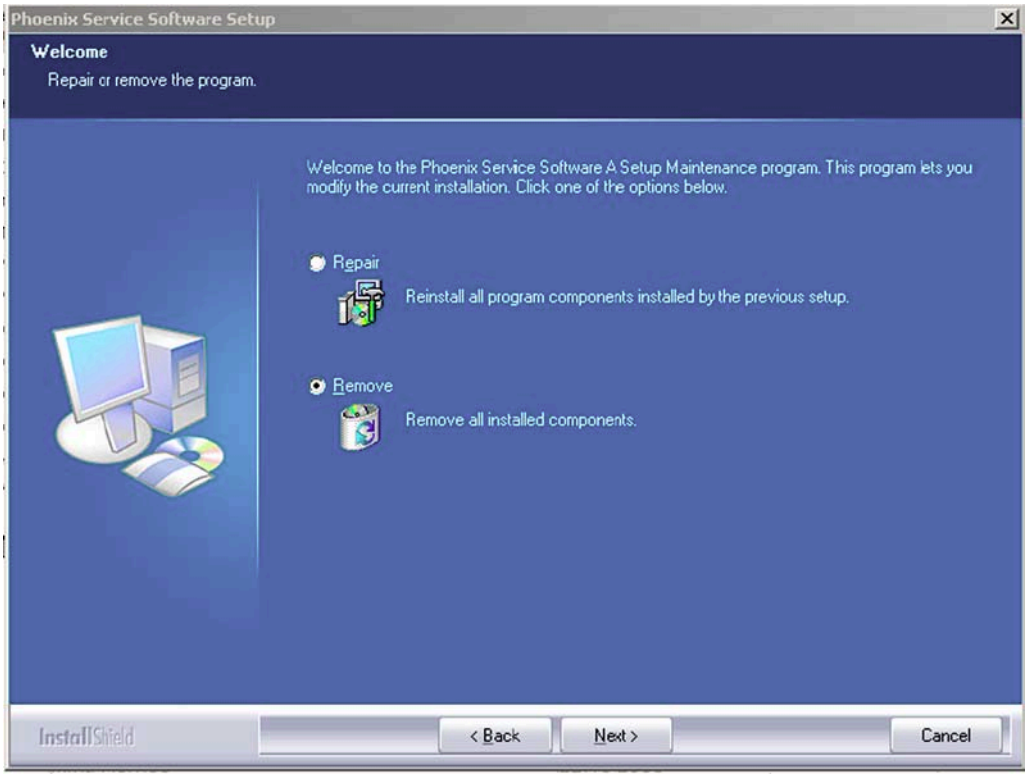


Figure 7 Remove program

The progress of the uninstallation is shown.

3. If the operating system does not require rebooting, click **Finish** to complete.

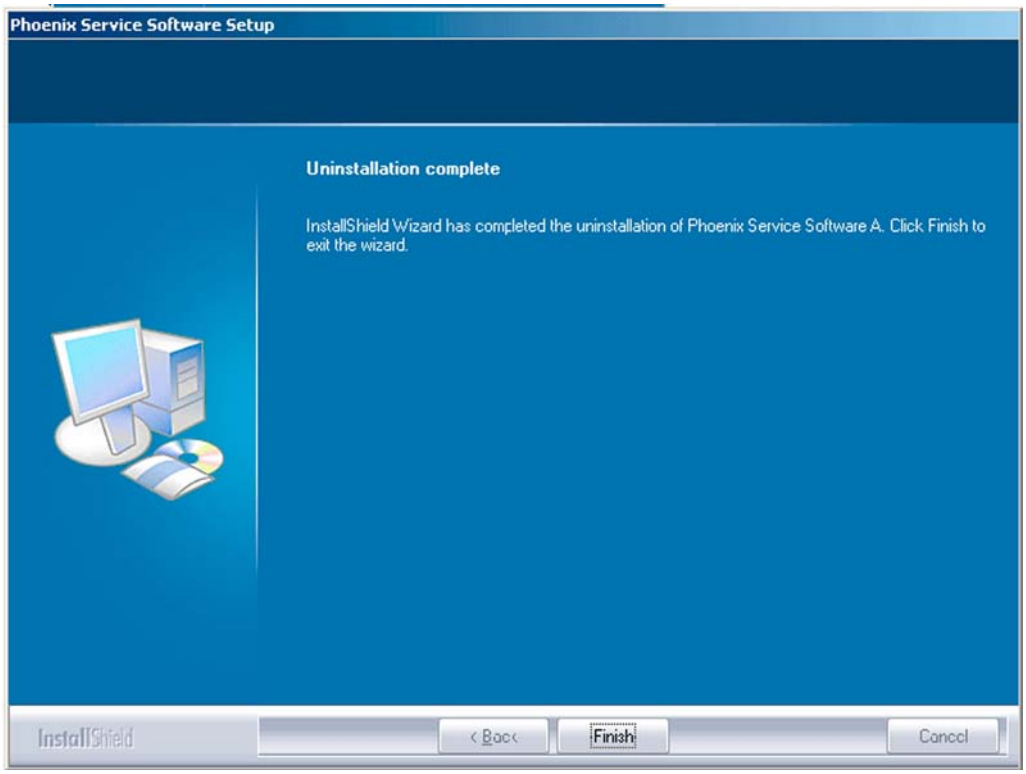


Figure 8 Finish uninstallation

If the operating system requires rebooting, InstallShield Wizard will notify you. Select **Yes...** to reboot the PC immediately and **No...** to reboot the PC manually afterwards.

Repairing *Phoenix* installation

Context

If you experience any problems with the service software or suspect that files have been lost, use the repair function before completely reinstalling *Phoenix*.

Note: The original installation package (for example, *phoenix_service_sw_a15_2004_24_7_55.exe*) must be found on your PC when you run the repair setup.

Steps

1. Open **Windows Control Panel→Add/Remove Programs** .
2. Choose **Phoenix Service Software→Change/Remove** .
3. In the following view, select **Repair**.

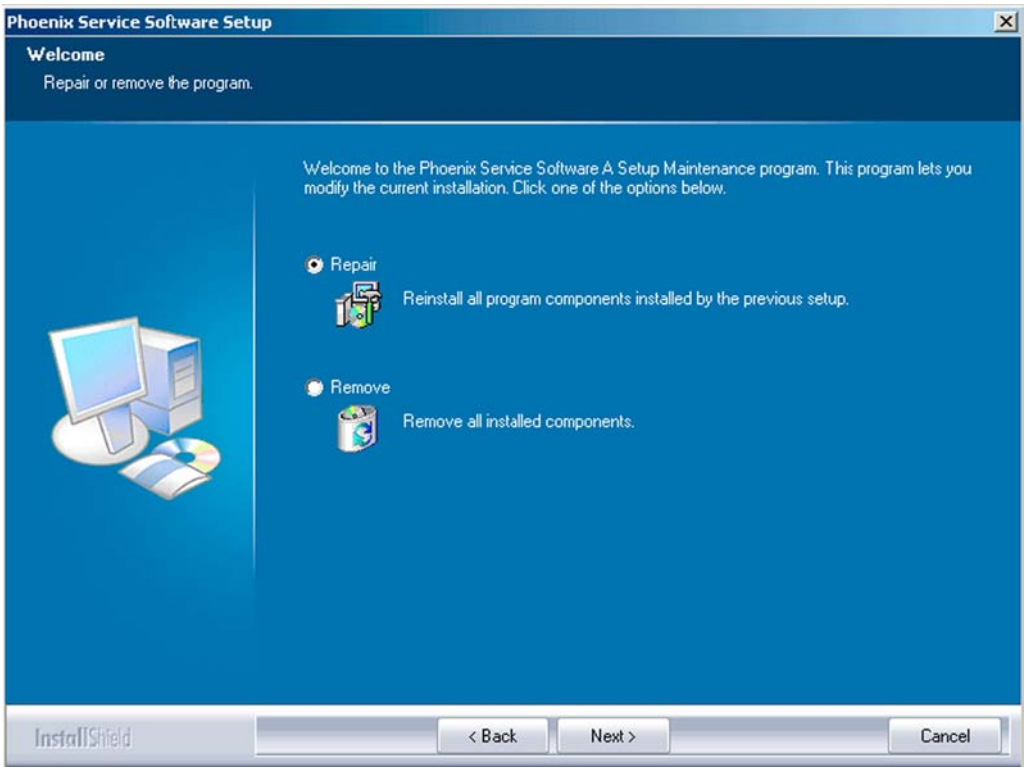


Figure 9 Repair program

Phoenix reinstalls components and registers them.

The procedure is the same as when updating *Phoenix*.

4. To complete the repair, click **Finish**.

Phone data package overview

Each product has its own data package (DP). The product data package contains all product-specific data files to make the Phoenix service software and tools usable with a certain phone model.

The phone data package contains the following:

- Product software binary files

- Files for type label printing
- Validation file for the fault log repair data reporting system
- All product-specific configuration files for Phoenix software components

Data files are stored in **C:\Program Files\Nokia\Phoenix** (default).

Installing phone data package

Prerequisites

- A phone-specific data package contains all data required for the *Phoenix* service software and service tools to be used with a certain phone model.
- Check that a dongle is attached to the parallel port of your computer.
- Install *Phoenix* service software.
- Download the installation package (for example, *XX-XX_dp_EA_v_1_0.exe*) to your computer (for example, in C:\TEMP).
- Close all other programs.

(XX-XX = type designator of the product)

If you already have *Phoenix* installed on your computer, you will need to update it when a new version is released.

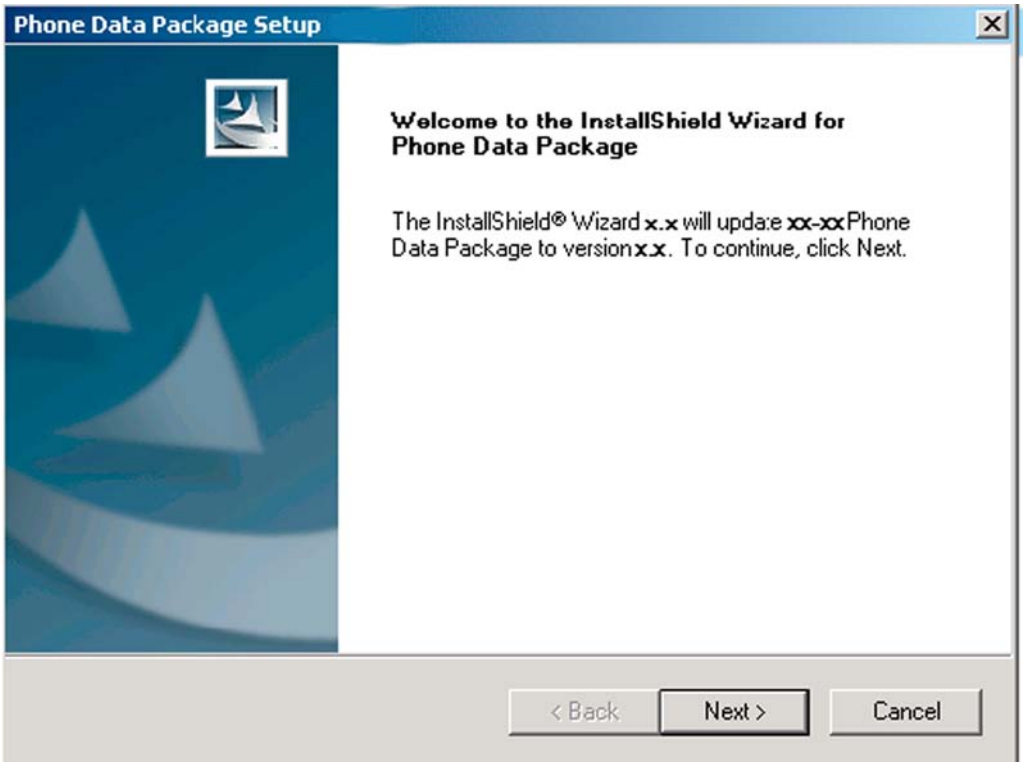
> **Note:** Often *Phoenix* and the phone-specific data package come in pairs, meaning that a certain version of *Phoenix* can only be used with a certain version of a data package. Always use the latest available versions of both. Instructions can be found in phone-specific Technical Bulletins and *readme.txt* files of data packages.

Steps

1. To start the installation, run the application file (for example, *XX-XX_dp_EA_ v_1_0.exe*),

   Wait for the installation files to be extracted.

2. Click **Next**.



3. In the following view you can see the contents of the data package. Read the text carefully. There is information about the *Phoenix* version required with this data package.

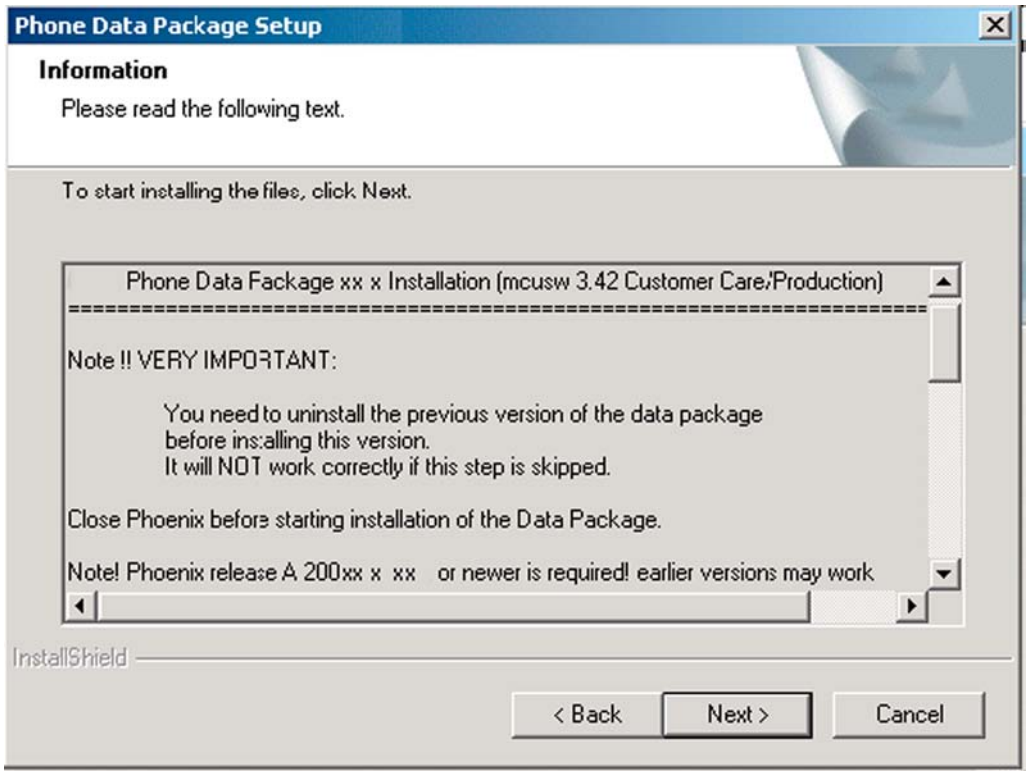


Figure 10 Data package setup information

4. To continue, click **Next**.

5. Choose the destination folder, and click **Next** to continue.

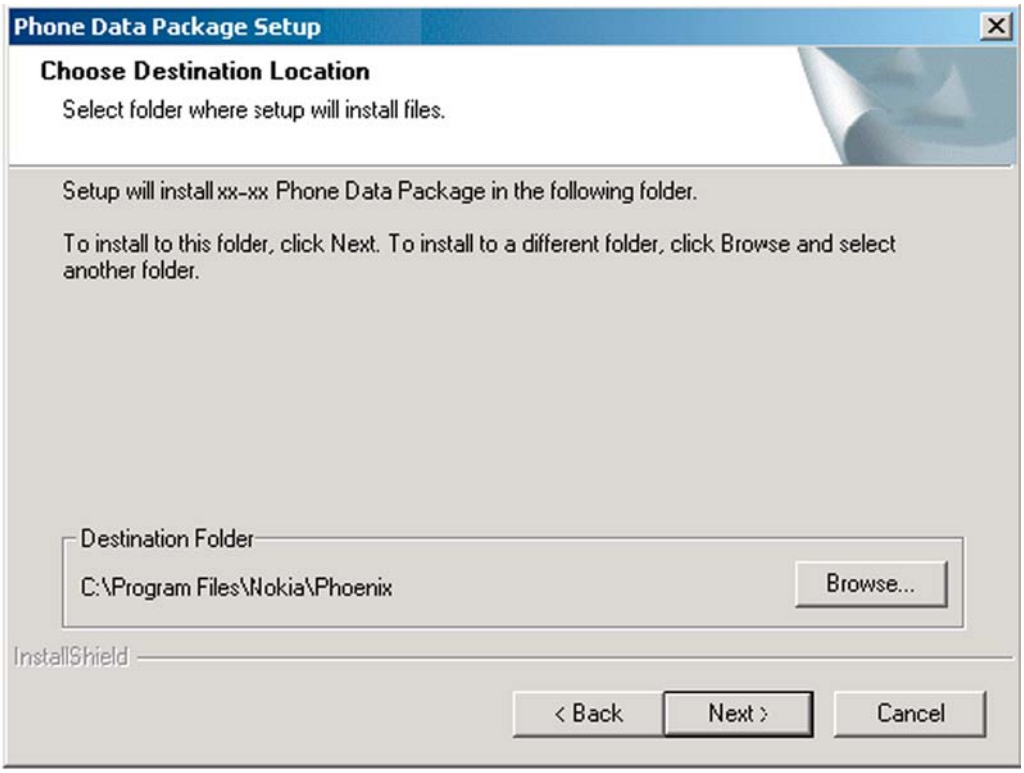
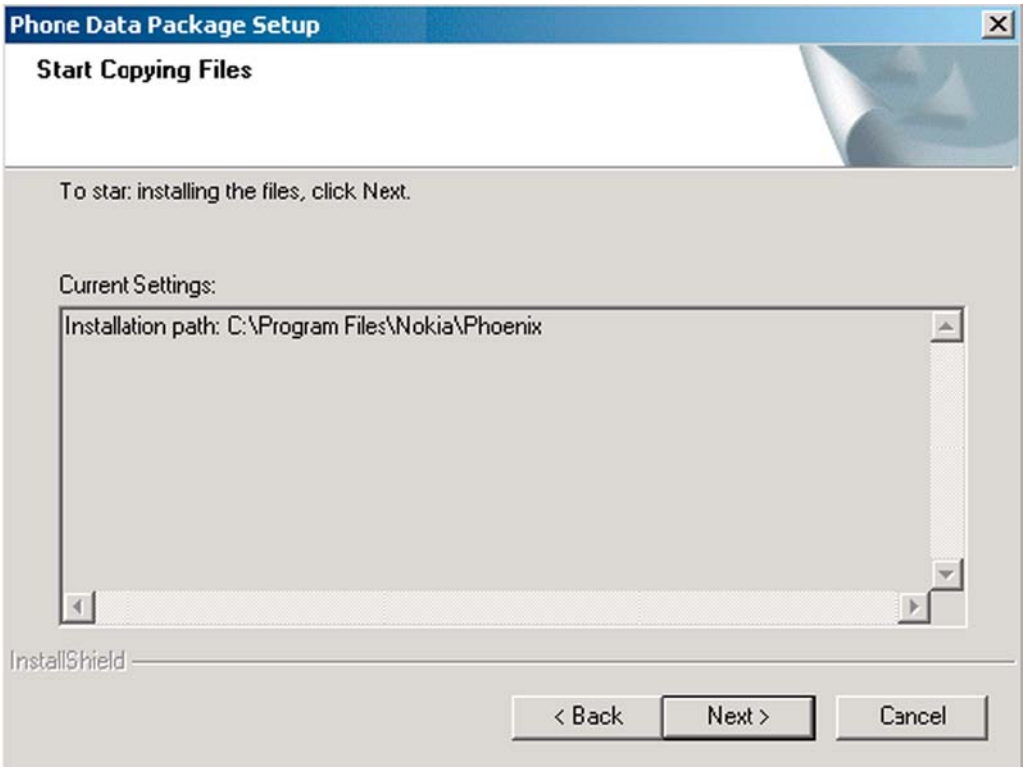


Figure 11 Data package destination folder

The InstallShield Wizard checks where *Phoenix* is installed, and the directory is shown.

6. To start copying the files, click **Next**.



Phone model specific files are installed. Please wait.

7. To complete the installation, click **Finish**.

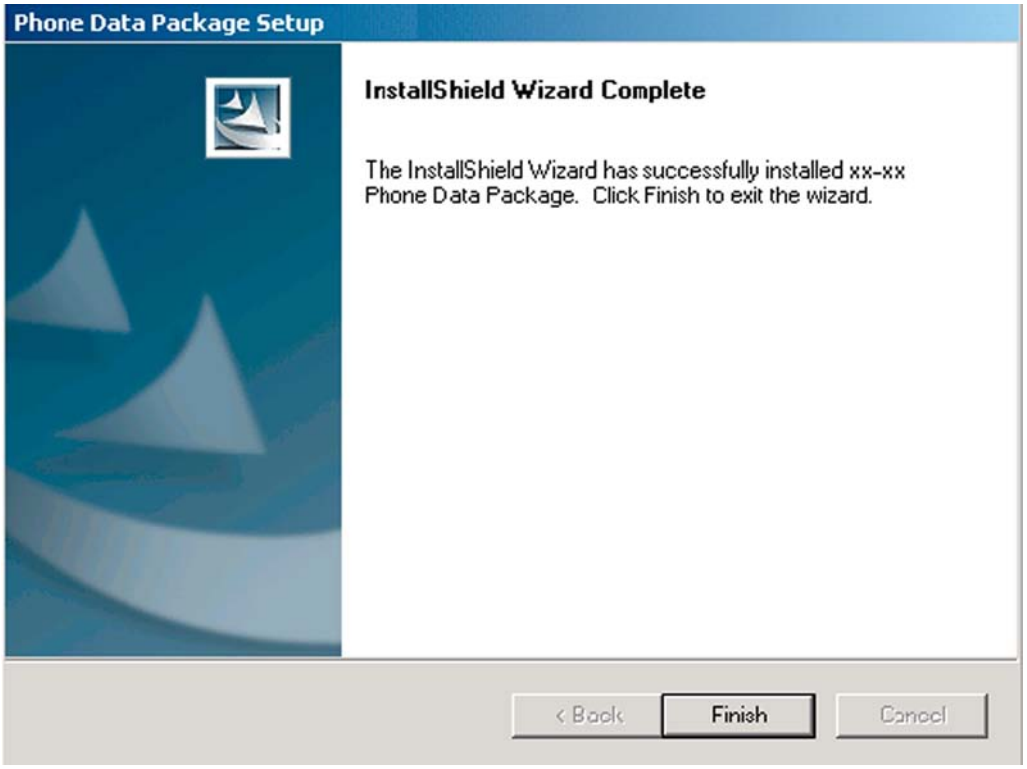


Figure 12 InstallShield Wizard Complete

Next actions

Phoenix can be used for flashing phones and printing type labels after:

- Configuring users
- Managing connections

FPS-10 can be used after updating their flash update package files.

Uninstalling phone data package

Context

There is no need to uninstall an older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

Please read all related documents carefully.

Steps

1. Locate the data package installation file (e.g. *XX-XX_dp_EA_v_1_0.exe*) from your computer.
2. To start the uninstallation procedure, double-click the data package installation file.

3. To uninstall the data package, click **OK** or to interrupt the uninstallation, click **Cancel**.

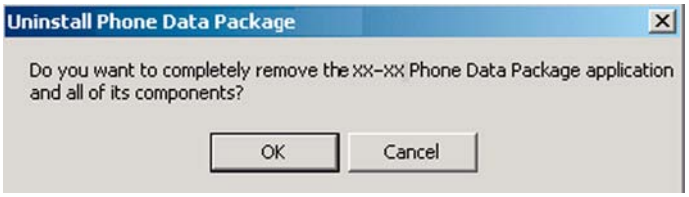


Figure 13 Uninstalling phone data package

4. When the data package is uninstalled, click **Finish**.

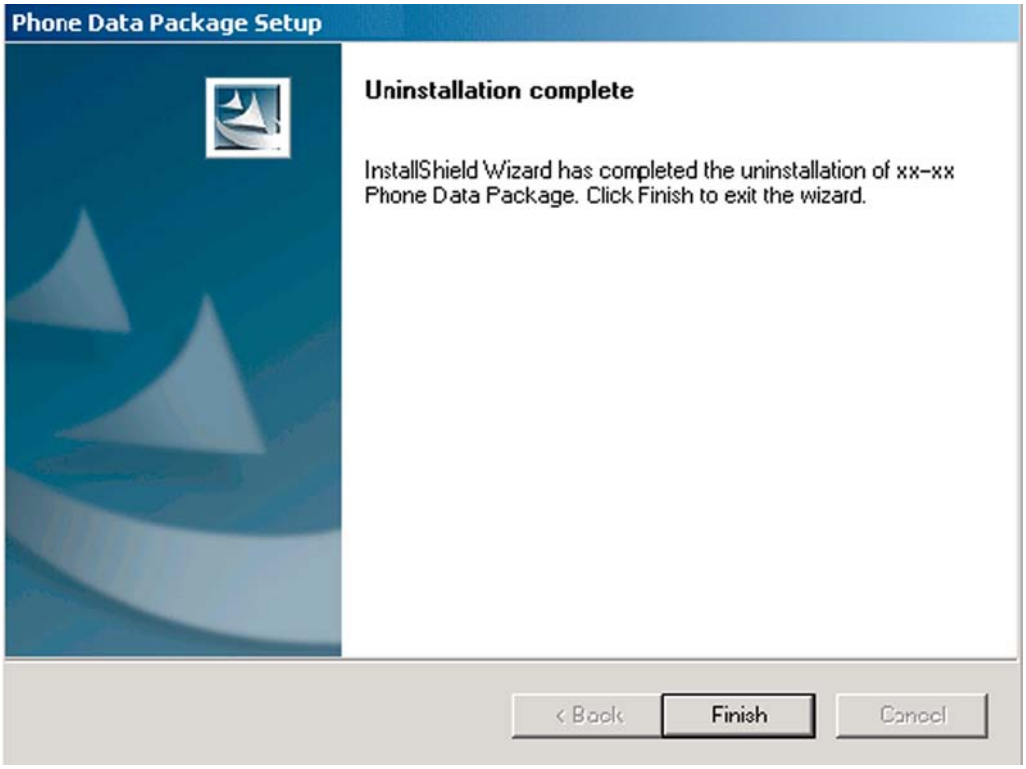


Figure 14 Finishing data package uninstallation

Alternative steps

- You can also uninstall the data package manually from **Control Panel→Add/Remove Programs→xx-xx* Phone Data Package** . (*= type designator of the phone).

Configuring users in *Phoenix*

Steps

1. Start *Phoenix* service software, and log in.

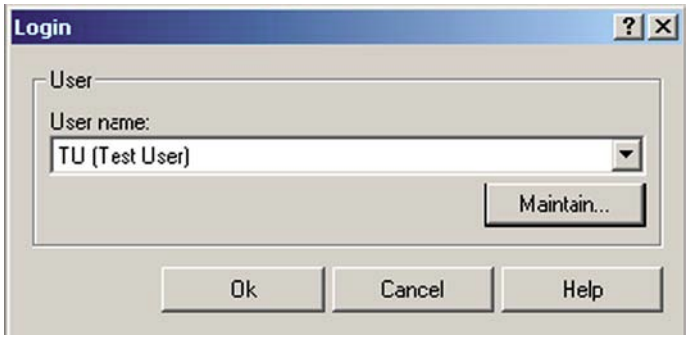


Figure 15 Phoenix login

   If the user ID is already configured, select s/he from the *User name* drop-down list, and click **OK**.
2. To add a new user, or to edit existing ones, click **Maintain**.
3. To add a new user, click **New**.
4. Type in the name and initials of the user, and click **OK**.
   The user is added to the user name list.
5. Select the desired user from the *User name* drop-down list, and click **OK**.

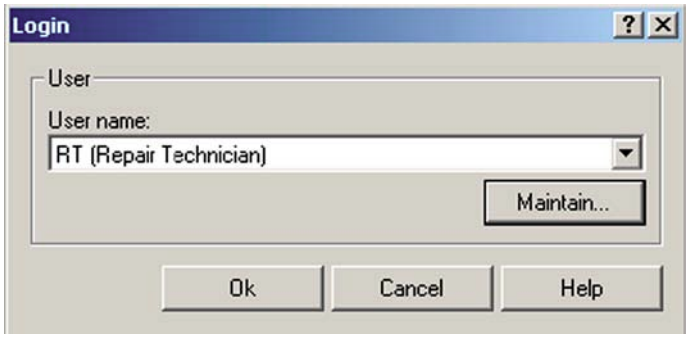


Figure 16 New user configured

Managing connections in *Phoenix*

Context

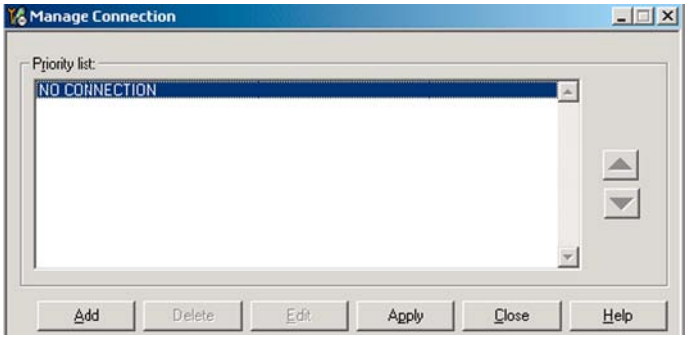
With the **Manage Connections** feature you can edit and delete existing connections or create new ones.

> **Note:** After choosing the desired connection, and connecting the phone to a PC for the first time, allow the PC to install the USB device drivers first. Please note that this may take some time to complete.
>
> If there are problems after the driver installation, check that the USB connection is active from the **Windows Control Panel**. If the problem persists, contact the local PC support.

Steps

1. Start *Phoenix*, and log in.
2. Choose **File→Manage Connections...** .

3. To add a new connection, click **Add**.



4. Select **Manual** mode, and click **Next** to continue.

   If you want to create the connection using the Connection Wizard, connect the tools and a phone to your PC. The wizard will automatically try to configure the correct connection.

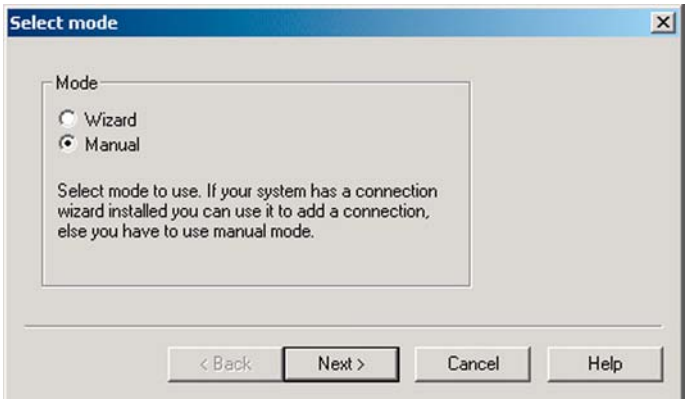


Figure 17 Select mode: Manual

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings:
   - Media: **FPS-10 USB**
   - DEVICE_INDEX: **0**
   - SERIAL_NUM: See Serial No from the label attached to the bottom of FPS-10
   - ACTIVE_MEDIA: **USB**

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings:
   - Media: **FPS-10 TCP/IP**
   - NET_SERV_NAME: Click **Scan...**. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
   - PORT_NUM: Use the default value, and click **Next**.
   - PROTOCOL_FAMILY: Use the default value, and click **Next**.
   - SOCKET TYPE: Use the default value, and click **Next**.
   - TX_BUFFER_SIZE: Use the default value, and click **Next**.
   - RX_BUFFER_SIZE: Use the default value, and click **Next**.

iii For an FPS-8 flash prommer, choose the following connection settings:
   - Media: FPS-8
   - PORT_NUM: COM Port where FPS-8 is connected
   - COMBOX_DEF_MEDIA: **FBUS**

iv For a plain **USB connection**, choose the following connection settings:

Note: First connect the DKE-2 USB cable between the PC USB port and phone.

- Media: USB

5. To complete the configuration, click **Finish**.
6. Click the connection you want to activate. Use the up/down arrows located on the right hand side to move it on top of the list, then click **Apply**.

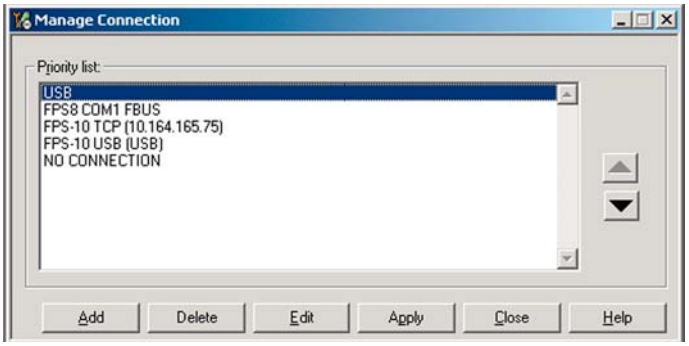


Figure 18 Connections list

The connection is activated, and it can be used after closing the *Manage Connection* window.

The connection information is shown at the right hand bottom corner of the screen.

Figure 19 Connection information

7. To use the connection, connect the phone to your PC with correct service tools. Make sure the phone is switched on, and then choose **File→Scan Product** .

Results

The product support module information appears in the status bar:

Figure 20 Product support module information (example from RM-1)

Installing flash support files for FPS-10

Prerequisites

Note: You need to install flash support files for FPS-10 only, if you don't have the latest Phoenix available or the flash support files have changed after the latest Phoenix release.

- Flash support files are installed automatically, when you install Phoenix. Use Phoenix packages later than June 2006.
- Normally it is enough to install Phoenix and the phone-specific data package because the Phoenix installation always includes the latest flash update package files for FPS-10.
- A separate installation package for flash support files is available, and the files can be updated according to this instruction, if updates appear between new Phoenix / data package releases

Context

If you are not using a separate installation package, you can skip this section and continue with [[[ERROR: Unable to generate link title]]] (page) after installing a new phone data package.

Steps

1. To begin installation, double- click *flash_update_x_yy.exe* .

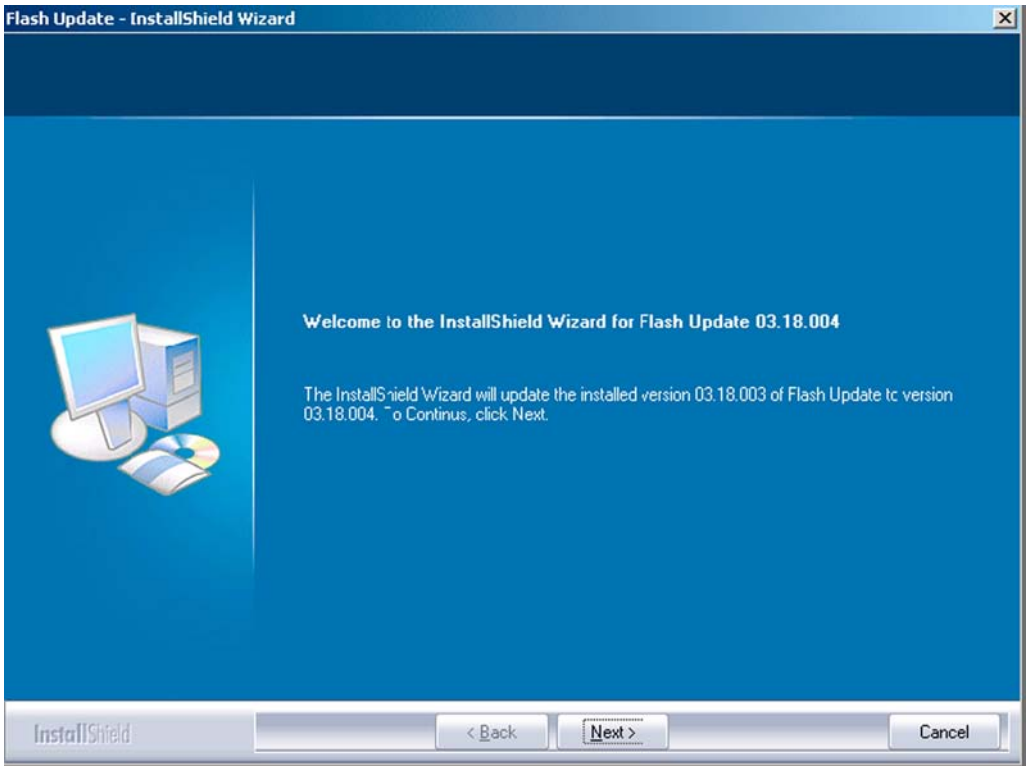


Figure 21 Flash update welcome dialog

If the same version of Flash Update package already exists, and you want to reinstall it, the previous package is first uninstalled. Restart installation again after that.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If you really want to downgrade, uninstall newer files manually from **Control Panel** and then rerun the installation again.

Figure 22 Flash installation interrupted

If an older version exists on your PC and it needs to be updated, click **Next** to continue installation.

3. It is highly recommended to install the files to the default destination folder *C:|Program Files|Nokia |Phoenix*. Click **Next** to continue.

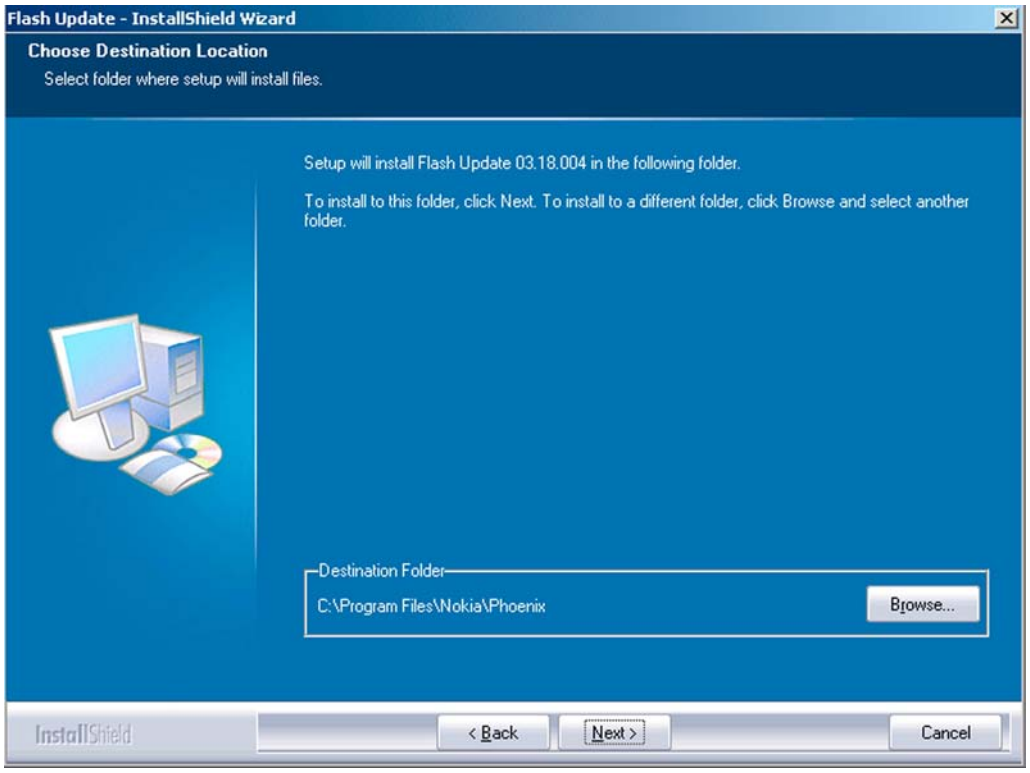


Figure 23 Flash destination folder

When installing the flash update files for the first time you may choose another location by selecting **Browse**. However, this is not recommended.

4. To complete the installation procedure, click **Finish** .

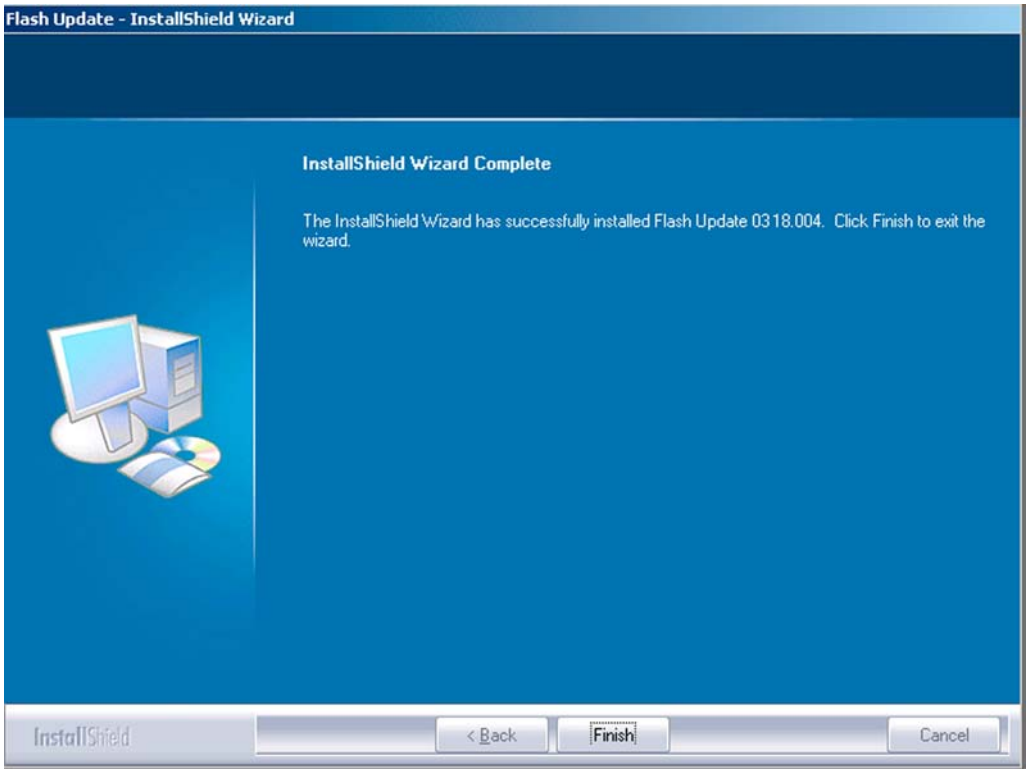


Figure 24 Finish flash update

Next actions

FPS-10 flash prommers must be updated using Phoenix!

Updating FPS-10 flash prommer software

Steps

1. Start *Phoenix Service Software* and log in, manage connection correctly for your flash prommer.
2. Choose **Flashing→Prommer maintenance** .
3. When the new flash update package is installed to the computer you will be asked to update the files to your Prommer. To update the files, click **Yes**. Click **OK** if the computer informs you about an unsafe removal of the device.
4. Alternatively you can update the FPS-10 flash prommer software by clicking the **Update** button.

5. Wait until you are notified that update has been successful; the procedure will take a couple of minutes. Click **OK** to close the *Update Done* window.

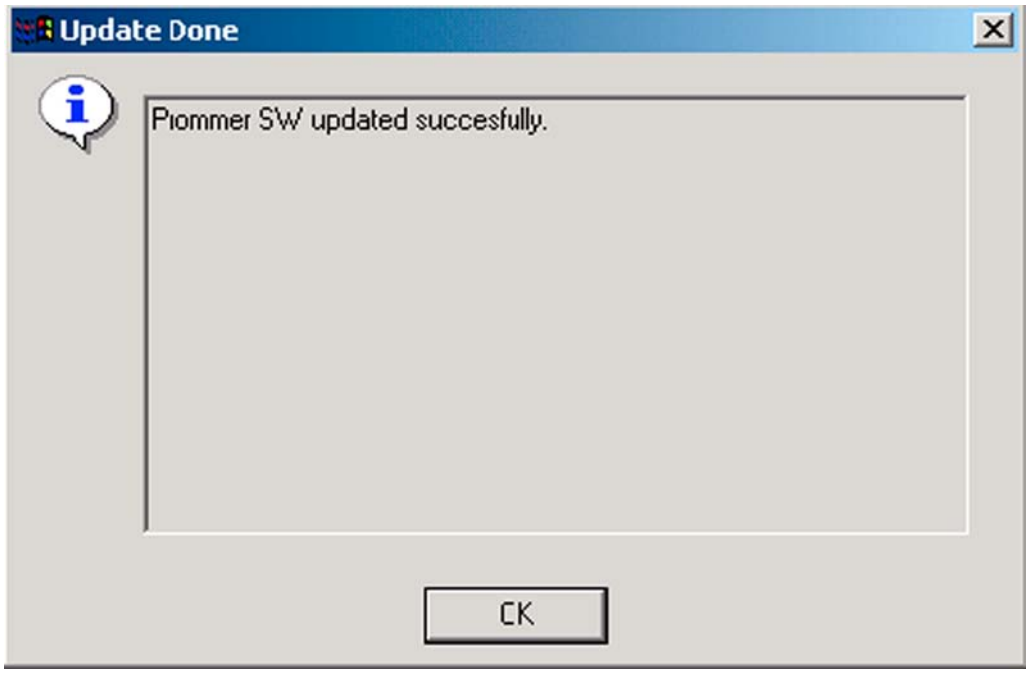


Figure 25 Prommer SW update finished

6. If you are using the FPS-10 flash prommer, check that it is detected from the progress info. Check also the status leds in the FPS-10. The MODE2 led (green), VBAT and POWER leds (red) should be lit. If you are using LAN connection, the LAN led (yellow) should be blinking.
7. Check that your FPS-10 flash prommer has enough memory. Flashing the RM-88 with FPS-10 needs at least 128 MB of SRAM memory in the prommer.

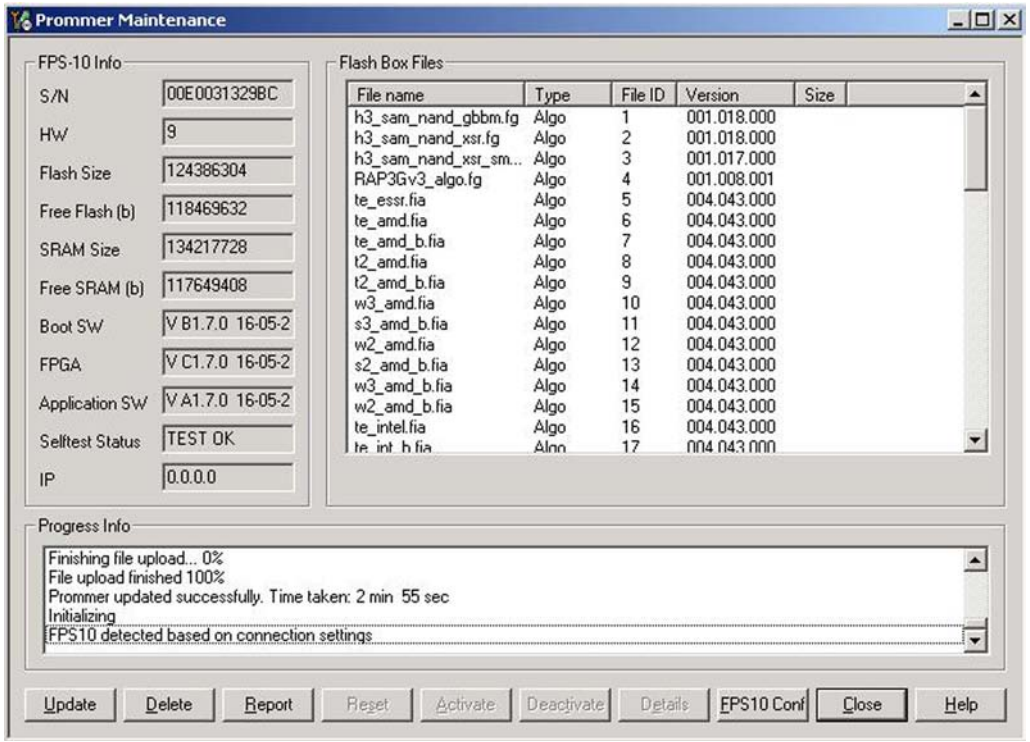


Figure 26 Prommer maintenance window

Alternative steps

- You can update FPS-10 SW by clicking the **Update** button and selecting the appropriate fpsxupd.ini file in *C:|Program Files|Nokia|Phoenix|Flash*.

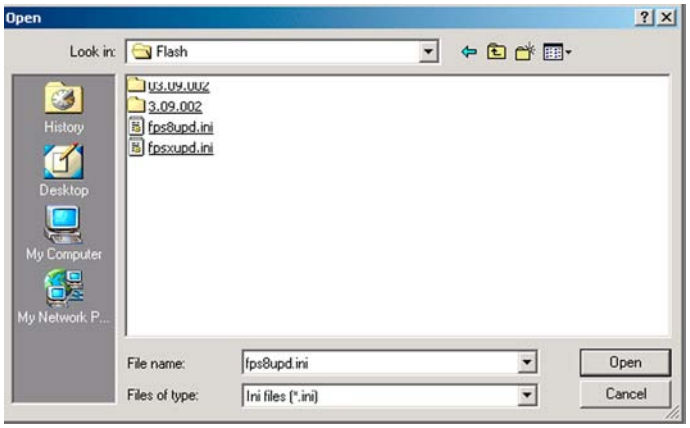


Figure 27 Flash directory window

- All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash box files* window and select the file type to be loaded.

  More information can be found in Phoenix **Help**.

4 — Service Tools and Service Concepts

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Table of Contents

List of Tables

List of Figures

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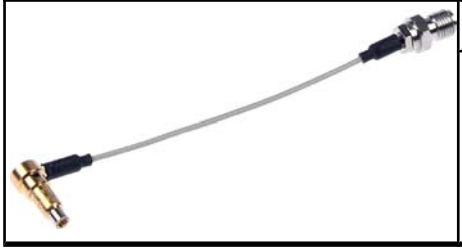
Service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-88, refer to various concepts.

	AC-34	Universal power supply	
	Universal power supply		
	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		
	CA-56RS	RF cable	
	Small RF cable that is used for RF tuning with MJ-67 module jig.		

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.

Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

	DKE-2	Mini-USB cable	
	USB to mini-USB connector cable.		
	FLS-4S	Flash device	
	FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.		
	FPS-10	Flash prommer	
	FPS-10 interfaces with: • PC • Control unit • Flash adapter • Smart card FPS-10 flash prommer features: • Flash functionality for BB5 and DCT-4 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command FPS-10 sales package includes: • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable		

FS-5	Product specific adapter	

RM-88/RM-89 specific adapter.

MJ-67	Module jig	

RM-88/RM-89 specific module jig.

- **Table 7 Attenuation table for MJ-67**

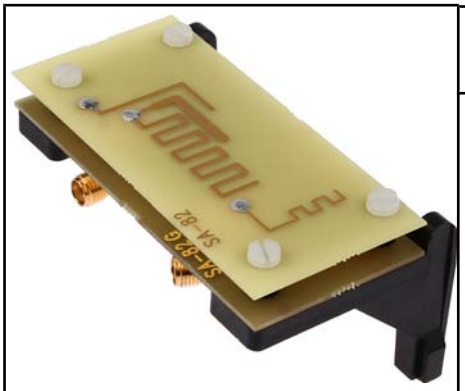
System	Channel	Tx/Rx-att. (dB)
GSM 850	128	0.2
	190	0.1
	251	0.1
GSM 900	975	0.1
	38	0.1
	124	0.2
GSM 1800	512	0.3
	698	0.2
	885	0.1
GSM 1900	512	0.5
	700	0.6
	810	0.8

Measured with Universal Radio Communication Tester CMU-200.

Note: Tx-attenuation tolerance is +/- 0.5dB
Rx-attenuation tolerance is +/- 1.0 dB

RJ-86	Soldering jig	

RM-88/RM-89 specific soldering jig.



SA-82	Flash adapter antenna coupler	

RM-88/RM-89 specific flash adapter antenna coupler.

- Flash adapter antenna coupler SA-82 attenuation table for NOKIA E62, measured with Universal Radio Communication Tester CMU-200.

Table 8 Attenuation table for antenna coupler SA-82

System	Channel	Tx-att. (dB)	Rx-att. (dB)
GSM 850	128	5.8	4
	190	5.3	3
	251	5.3	3
GSM 900	975	5.8	4
	38	5	4
	124	5	4
GSM 1800	512	7.7	6
	698	7.4	6
	885	7.2	5
GSM 1900	512	7.9	6
	700	6.2	6
	810	5.6	6

Note: Tx-attenuation tolerance is +/-0.5 dB.
Rx-attenuation tolerance is +/-1.0dB.

SRT-6	Opening tool	

SRT-6 is used to open phone covers and B-to-B connectors.

	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-10.		
	SS-62	Generic flash adapter base for BB5	
	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB		
	SS-76	Domesheet assembly jig	

Service concepts

Flash concept with FPS-10

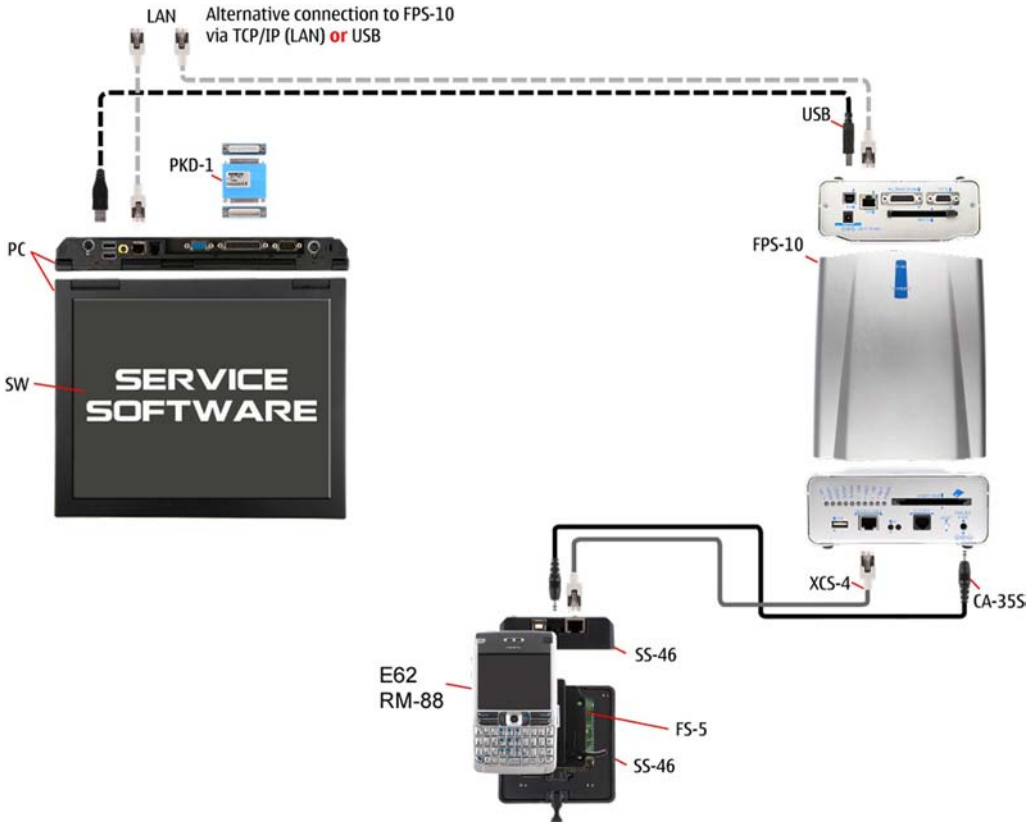


Figure 28 Basic flash concept with FPS-10

Description	Type
FS-5	Flash adapter
SS-46	Interface adapter
CA-35S	Power cable
XCS-4	Modular cable
	Standard USB cable
FPS-10	Flash prommer box
	Standard USB cable
PKD-1	SW security device

MJ-67 module jig concept

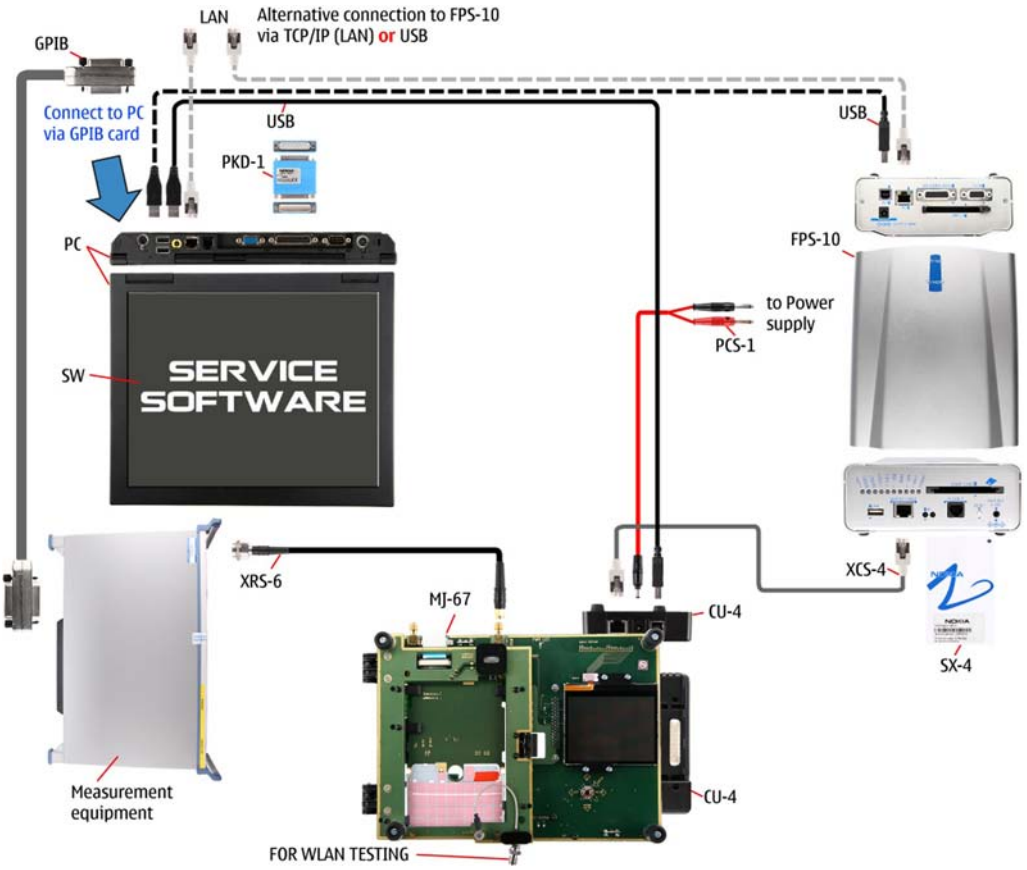


Figure 29 MJ-67 module jig service concept

Type	Description
MJ-67	Module jig
CU-4	Control unit
FPS-10	Flash prommer box
SX-4	Smart card
XCS-4	Modular cable
PCS-1	DC power cable
	Standard USB cable
	Standard USB cable
	GPIB control cable
XRS-6	RF cable
PKD-1	SW security device
	RF shield box

POS (Point of Sale) flash concept

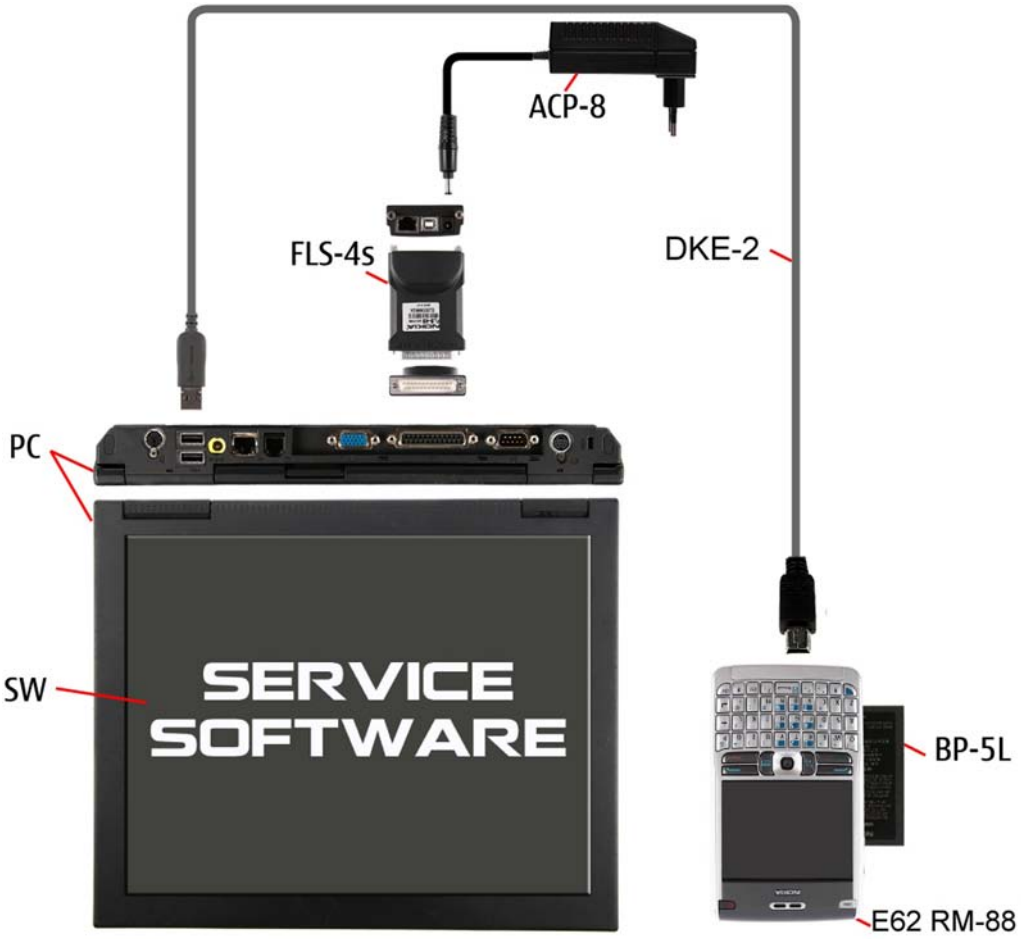


Figure 30 POS flash concept

Type	Description
CA-53	USB connectivity cable
FLS-5	POS flash device
ACP-8	Power adapter

Service concept for RF testing and RF/BB tuning

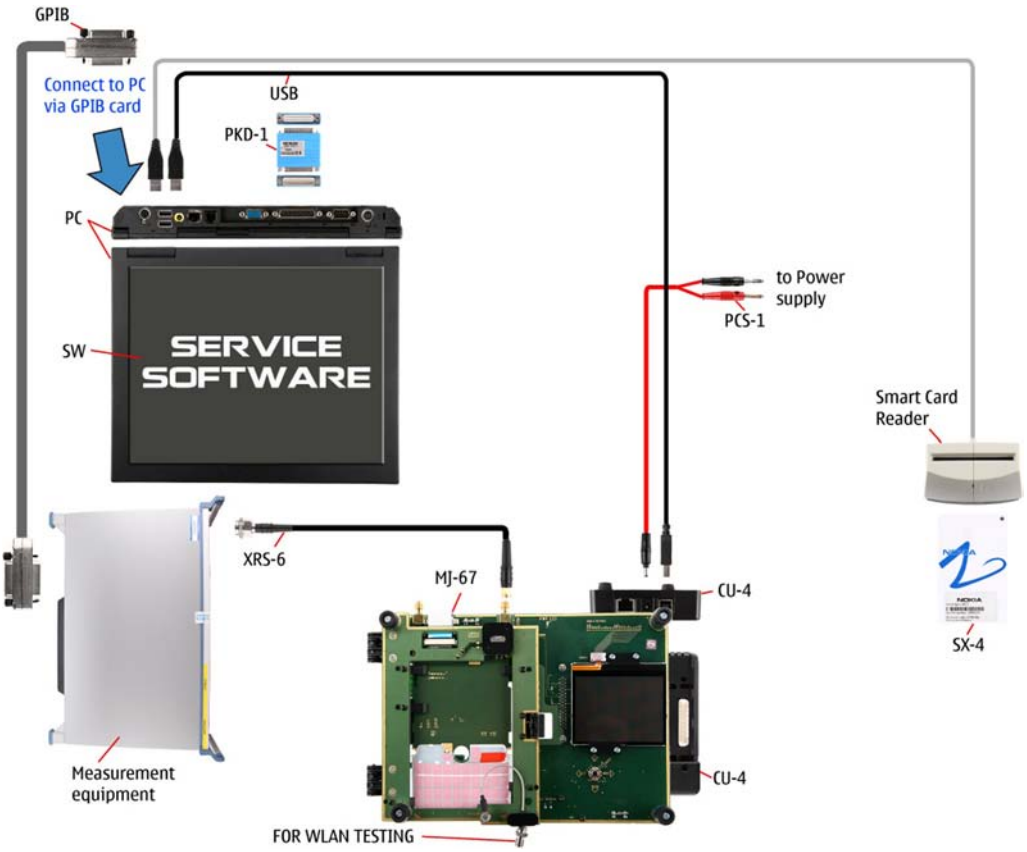


Figure 31 Service concept for RF testing and RF/BB tuning

Description	Type
MJ-67	Module jig
CU-4	Control unit
	Standard USB cable
PCS-1	DC power cable
	Standard USB cable + smart card reader
SX-4	Smart card
XRS-6	RF cable
	GPIB control cable
PKD-1	SW security device
	RF shield box

CU-4 flash concept with FPS-10

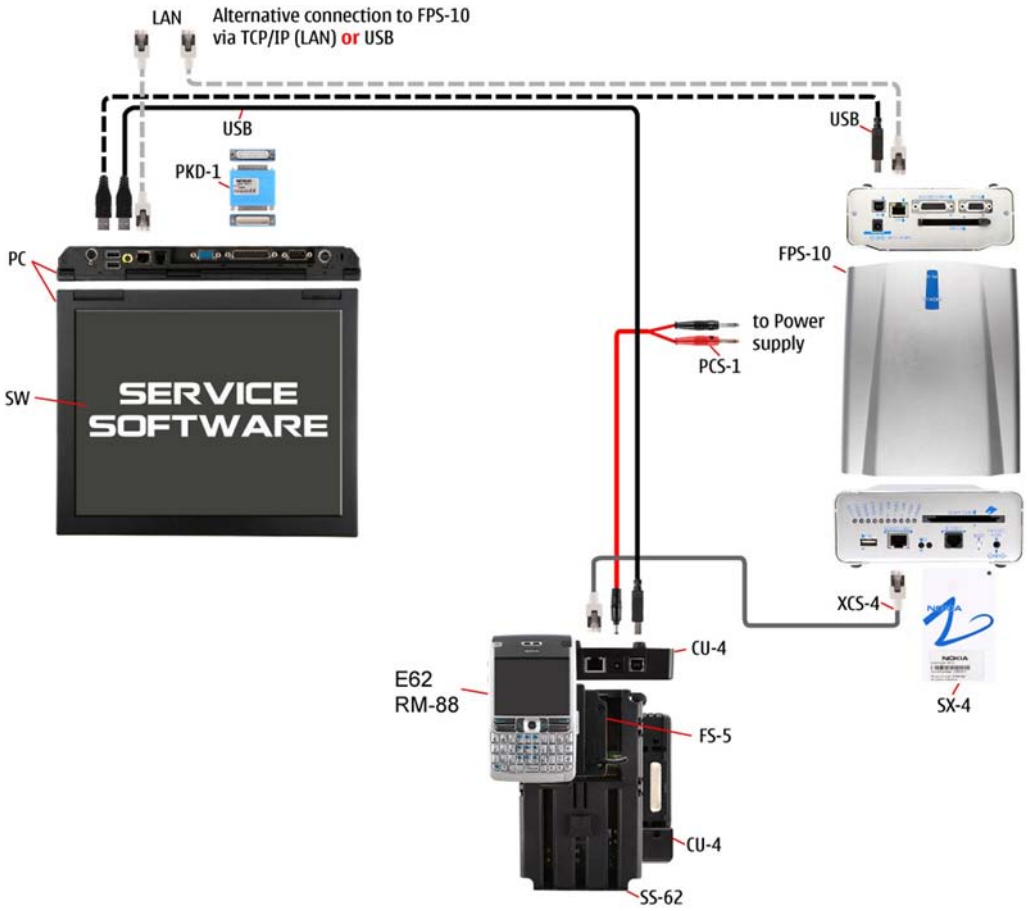


Figure 32 CU-4 flash concept with FPS-10

Note: FPS-8 concept can also be used for flashing.

Description	Type
SS-62/FS-5	Flash adapter
CU-4	Control unit
XCS-4	Modular cable
PCS-1	Power cable
FPS-10	Flash prommer box
	Standard USB cable
	Standard USB cable
PKD-1	SW security device

RF testing and BB testing/tuning

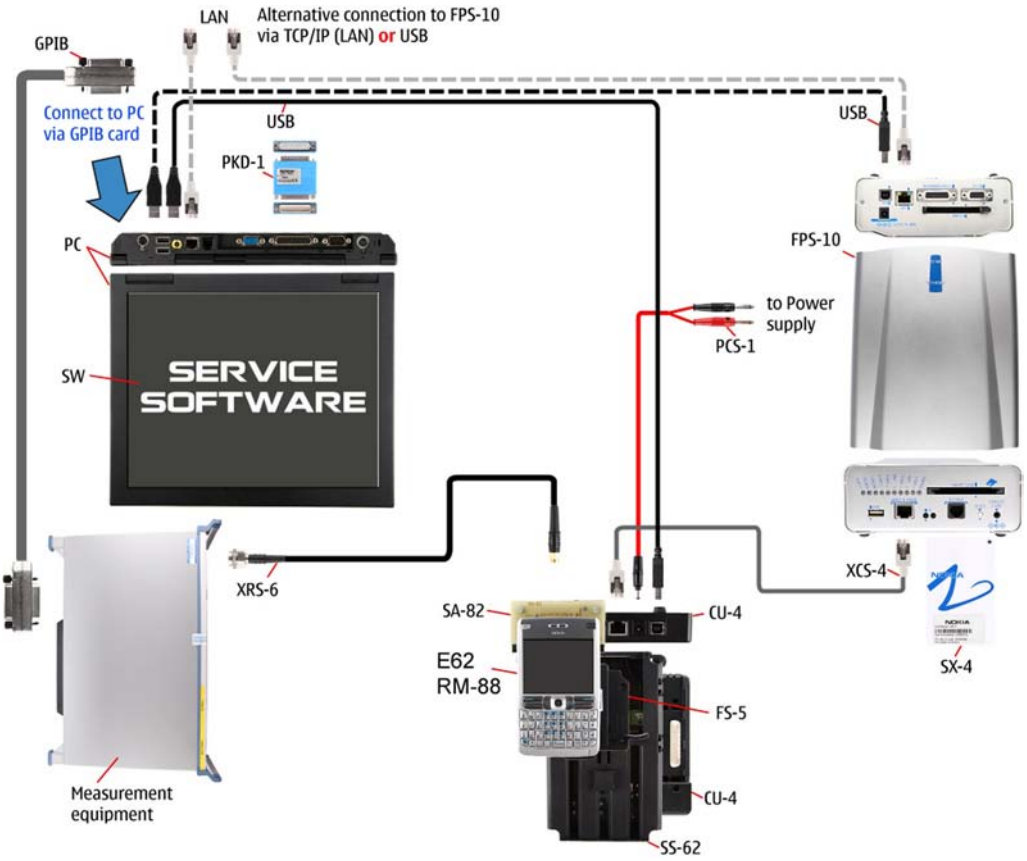


Figure 33 RF testing concept and BB testing/tuning

Type	Description
SS-62/FS-5	Flash adapter
CU-4	Control unit
SA-82	RF coupler
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	Standard USB cable + smart card reader
SX-4	Smart card
	GPIB control cable
XRS-6	RF cable
PKD-1	SW security device
	RF shield box

5 — Disassembly / Reassembly Instructions

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Table of Contents

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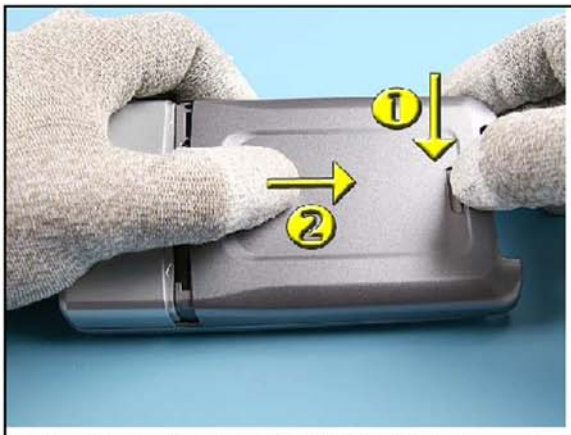
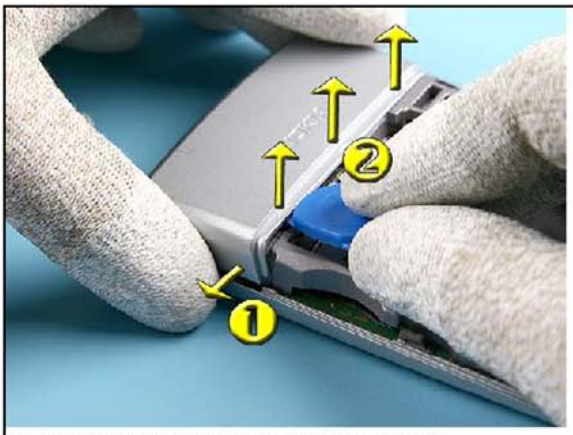
Disassembly instructions

1. Needed tools.

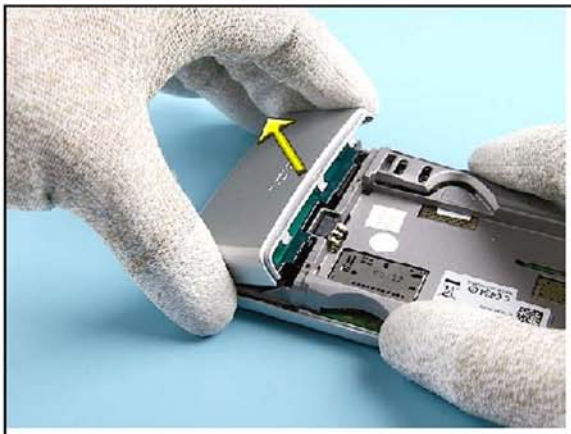
2. Cover the window with a protective film.



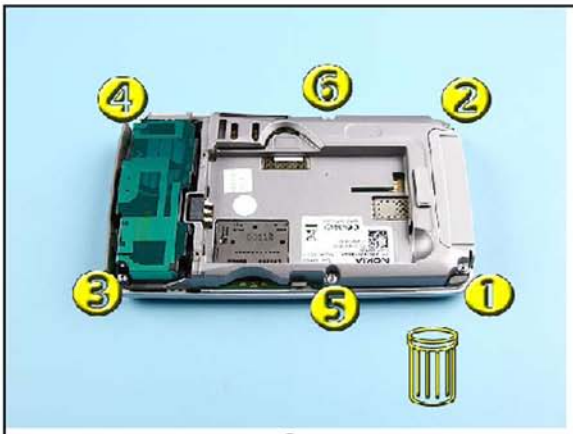
3. Push the BATTERY RELEASE BUTTON and remove the BATTERY COVER.



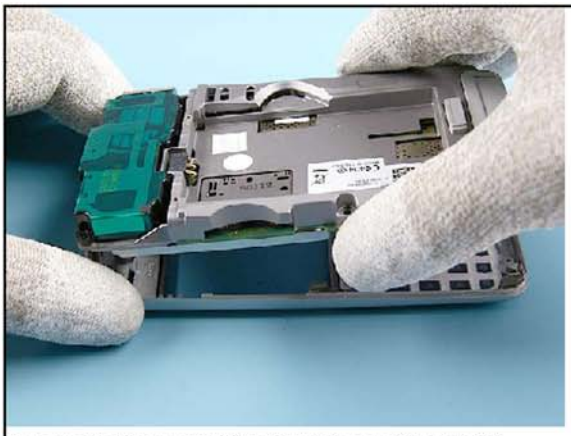
4. Unlock the snaps of the ANTENNA LID with the SRT-6.



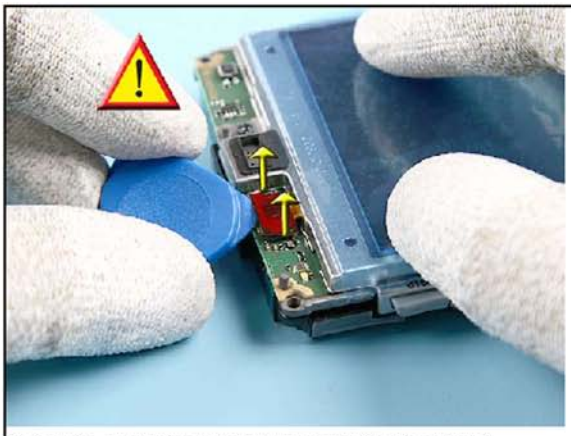
5. Carefully, lift up the ANTENNA LID.



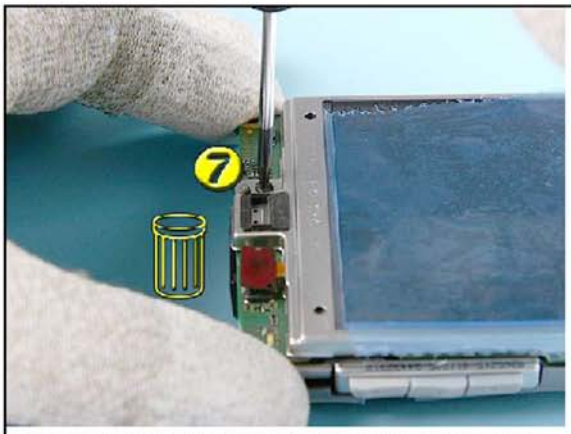
6. Unscrew the six Torx Plus® size 6 screws in the order shown. Do not reuse the screws.



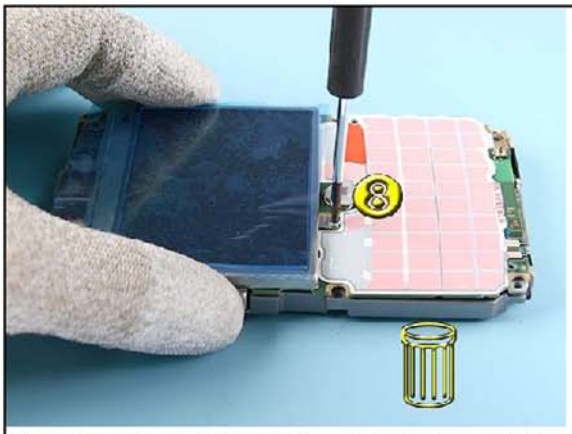
7. Remove the assemblies from the A-COVER ASSY.



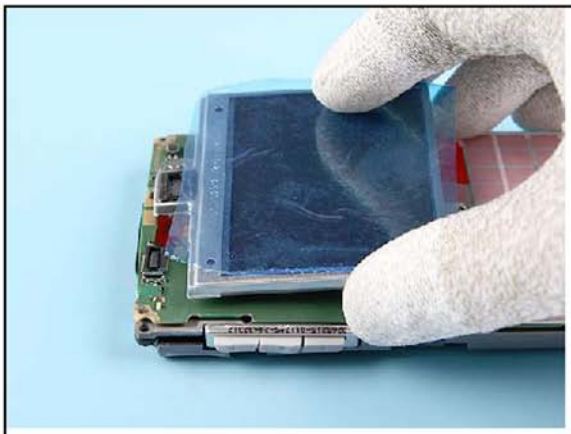
8. Gently, open the LCD connector with the SRT-6.



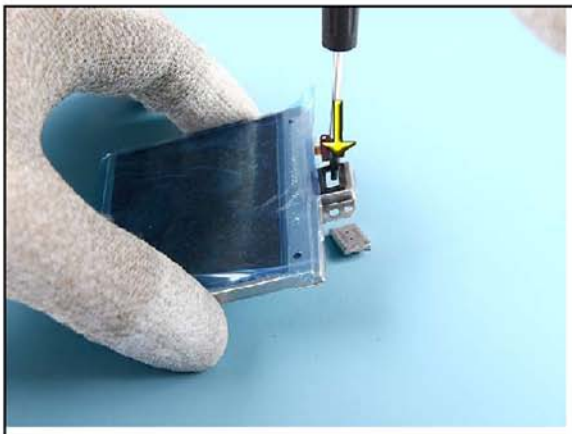
9. Unscrew the Torx Plus ® size 6 screw. Do not reuse the screw.



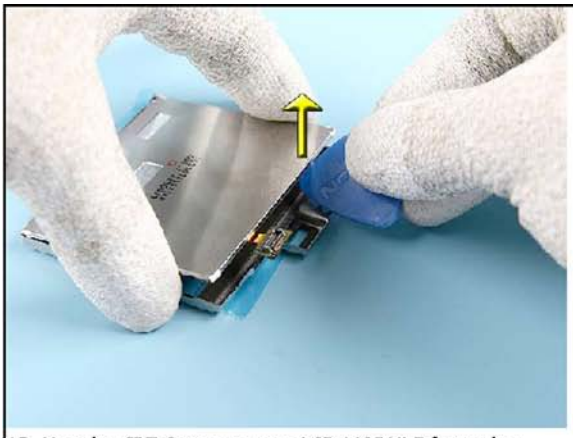
10. Unscrew the Torx Plus ® size 4 screw. Do not reuse the screw.



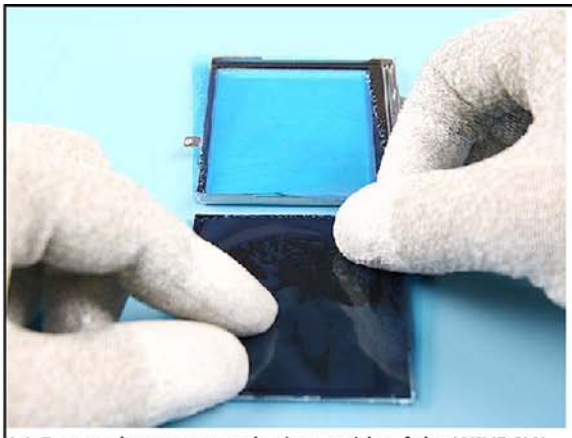
11. Remove the LCD MODULE and the WINDOWS ASSY.



12. The EARPIECE drops out easily by pushing it down with a screwdriver.

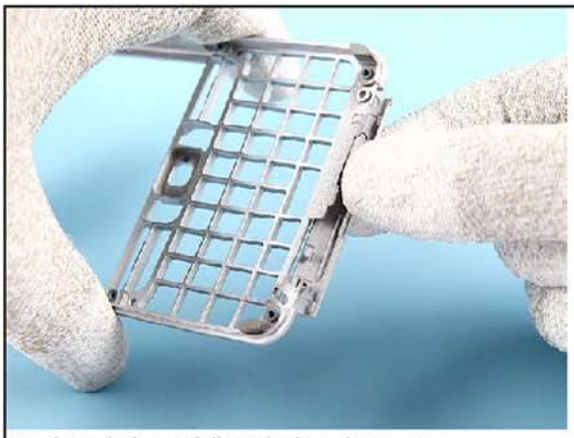


13. Use the SRT-6 to separate LCD-MODULE from the WINDOWS ASSY.

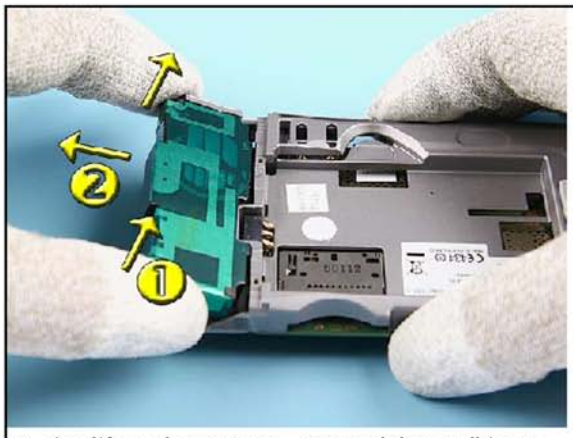


14. Remember to cover the inner side of the WINDOW ASSY end the LCD MODULE with protective film.

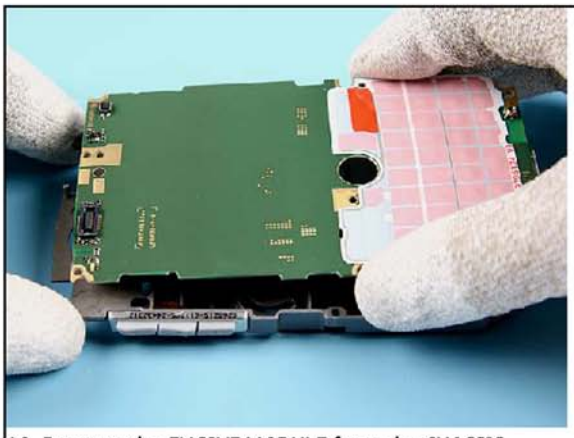
15. Separate the KEYMAT from the A-COVER ASSY.



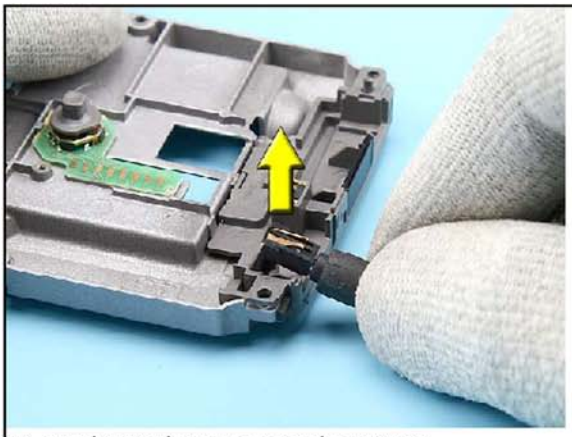
16. If needed, carefully unlock and remove the OPERATOR LOGO.



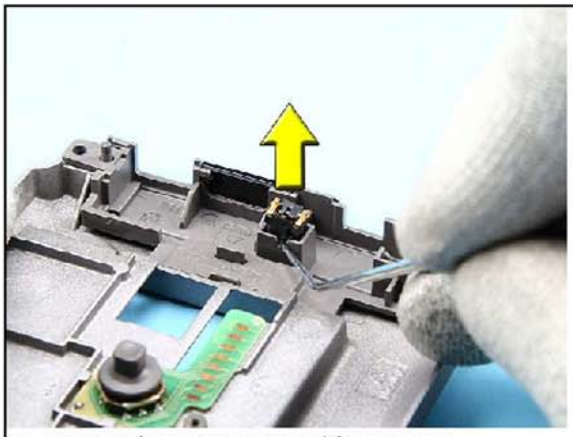
17. First lift up the ANTENNA ASSY and then pull it out.



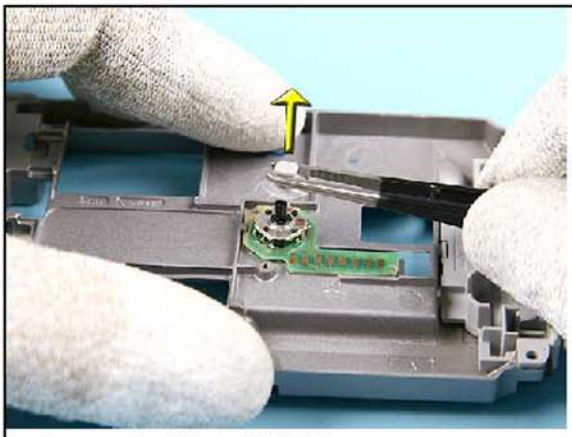
18. Remove the ENGINE MODULE from the CHASSIS.



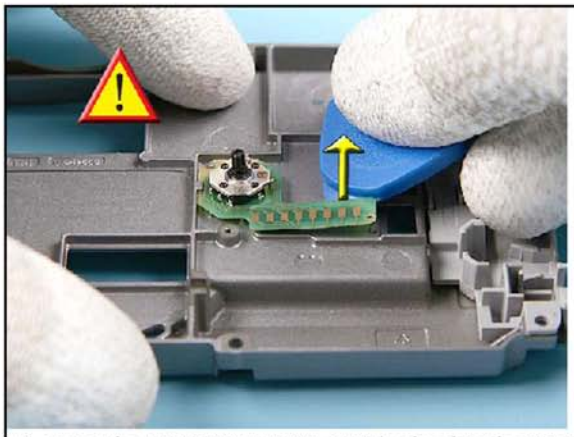
19. Use the DC plug to remove the DC-JACK.



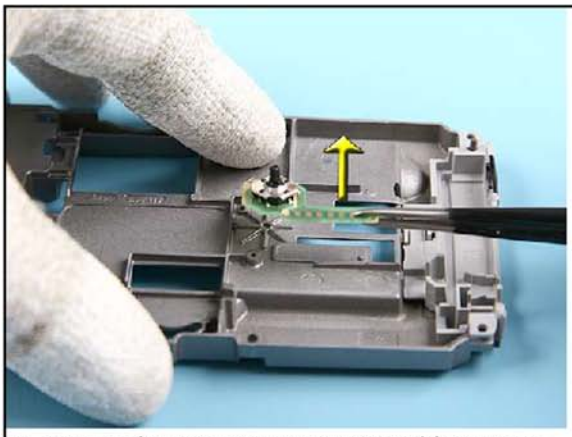
20. Remove the MICROPHONE with tweezers.
Avoid bending the spring contacts.



21. Remove the JOYSTICK MODULE.

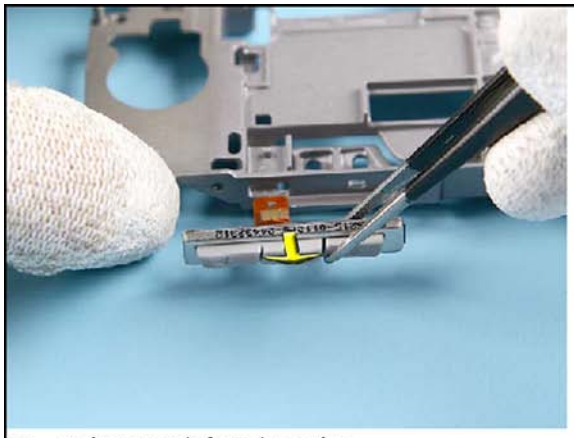


22. Note: The JOYSTICK BUTTON ASSY is glued to the CHASSIS.
Carefully, separate the parts from each other with SRT-6.



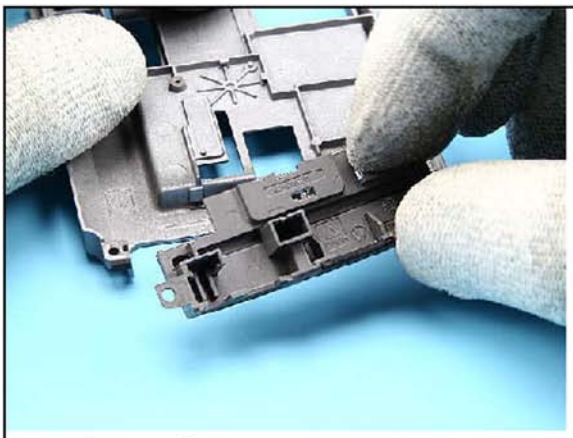
23. Remove the JOYSTICK BUTTON ASSY with tweezers.

24. Unlock the SIDE BUTTON MODULE ASSY...

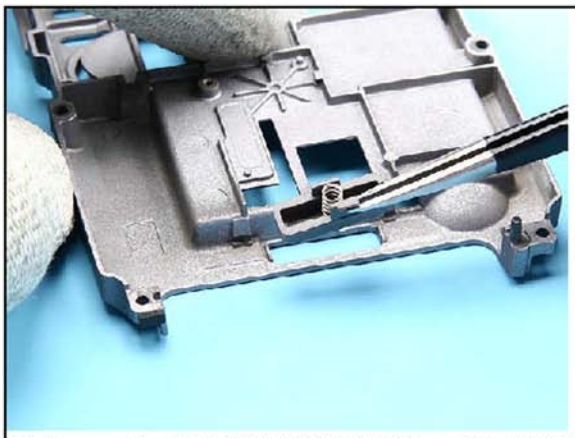


25. ...and remove it from its socket.

26. Unlock the both snaps of the CONNECTOR HOUSING INCL. IRDA WINDOW...

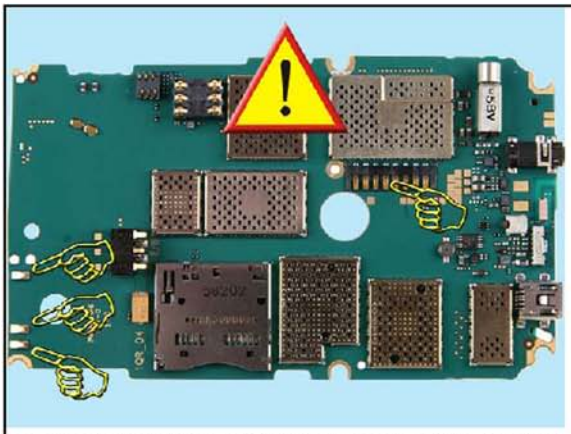


27. ...and remove it.

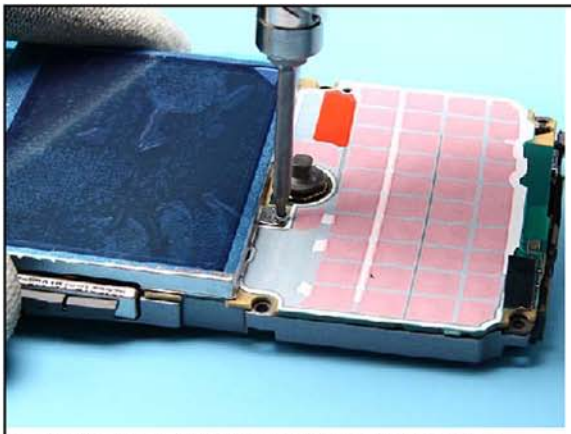


28. Remove the BATTERY RELEASE BUTTON and the BATTERY RELEASE SPRING.

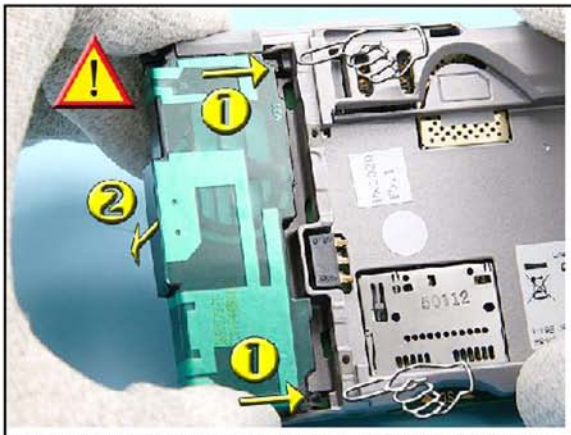
Tips for assembly



1. Take special care to all spring contacts on the ENGINE MODULE when assembling the unit.

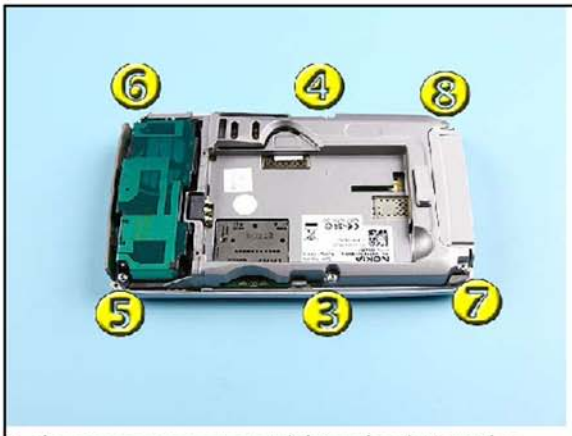


2. Always use a new screw. Tighten the Torx Plus size 4 screw to the torque of 17 Ncm.



3. First insert the guide pins of the ANTENNA ASSY into the recesses of the CHASSIS, then place the ANTENNA ASSY it into its socket.

4. Always use a new screw. To avoid damaging the plastic thread, first turn the screw slightly left to engage the thread and then tighten it to the torque of 22 Ncm.



5. Always use new screws. Tighten the six Torx Plus size 6 screws to the torque of 17 Ncm in the order shown.

6 — BB Troubleshooting and Manual Tuning Guide

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Table of Contents

List of Tables

List of Figures

Introduction to baseband troubleshooting

This chapter outlines the troubleshooting process for any baseband related problems reported from our customer. All troubleshooting by service technicians will be limited to those parts that are not under any shields.

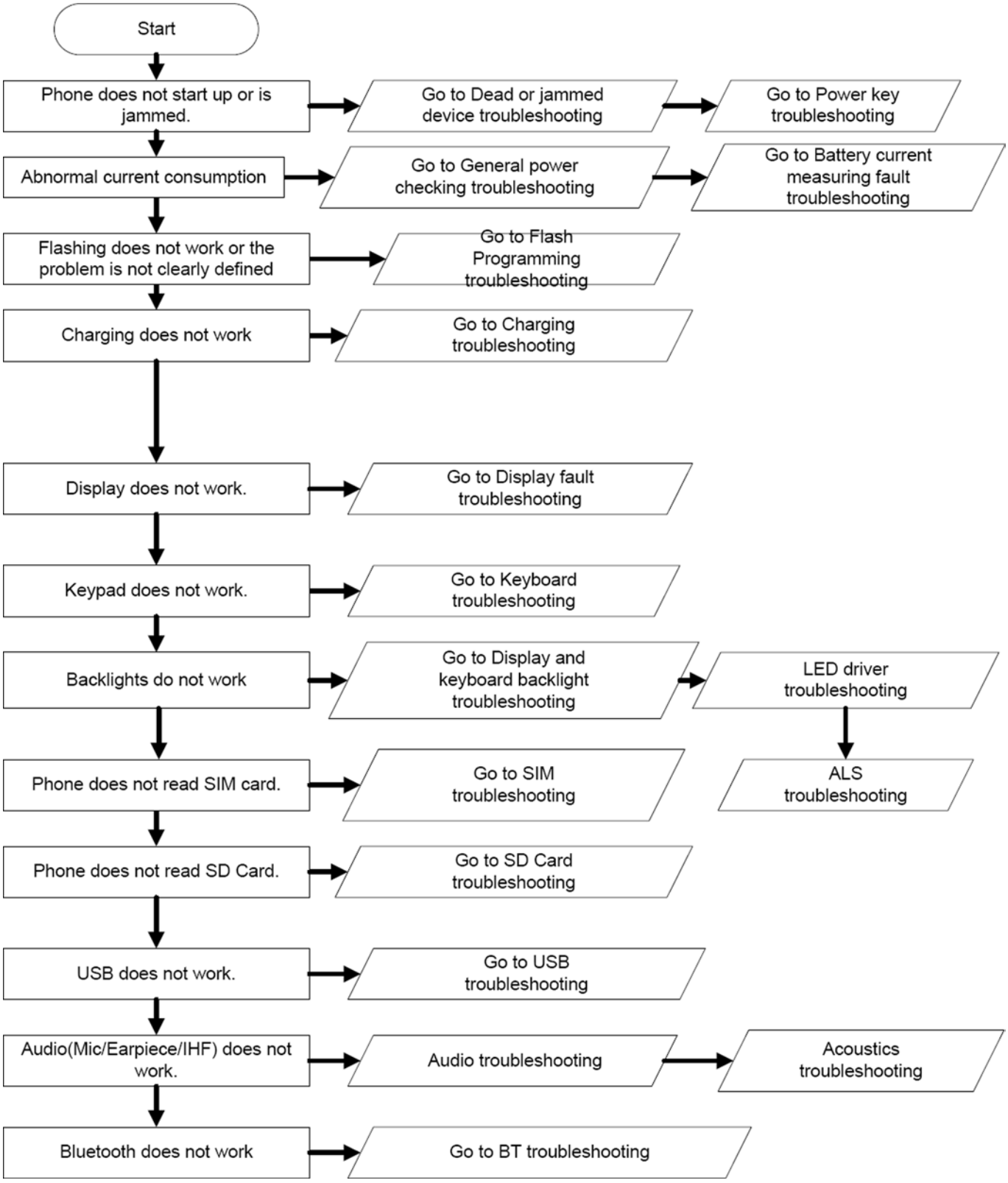
Basic Troubleshooting for RM-88

The most likely problems that may be reported with RM-88 engine are listed below.

- Phone does not power up or gets jammed during startup.
- Abnormal current consumption.
- Flashing does not work.
- Charging does not work.
- Display does not work.
- Keypad does not work.
- Display backlight does not work.
- Keyboard EL dome sheet does light up.
- Mail indicator LED does not work.
- Phone gives SIM card error.
- Phone cannot access SD card.
- USB does not work.
- Audio (earpiece, microphone, and/or IHF) does not work.
- Audio headset does not work.
- Volume key does not work.
- Bluetooth does not work.
- IRDA does not work.

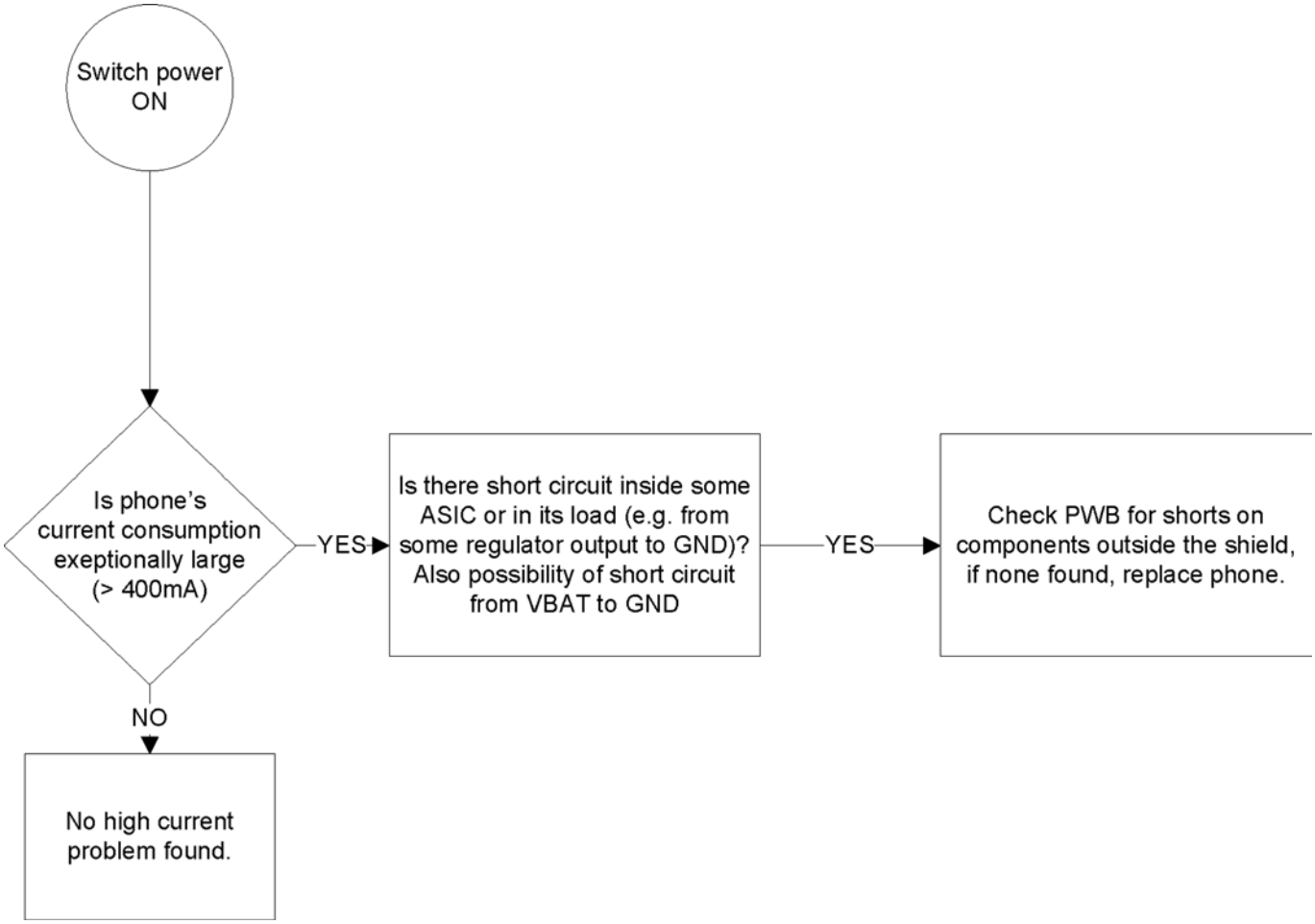
Baseband main troubleshooting

Troubleshooting flow



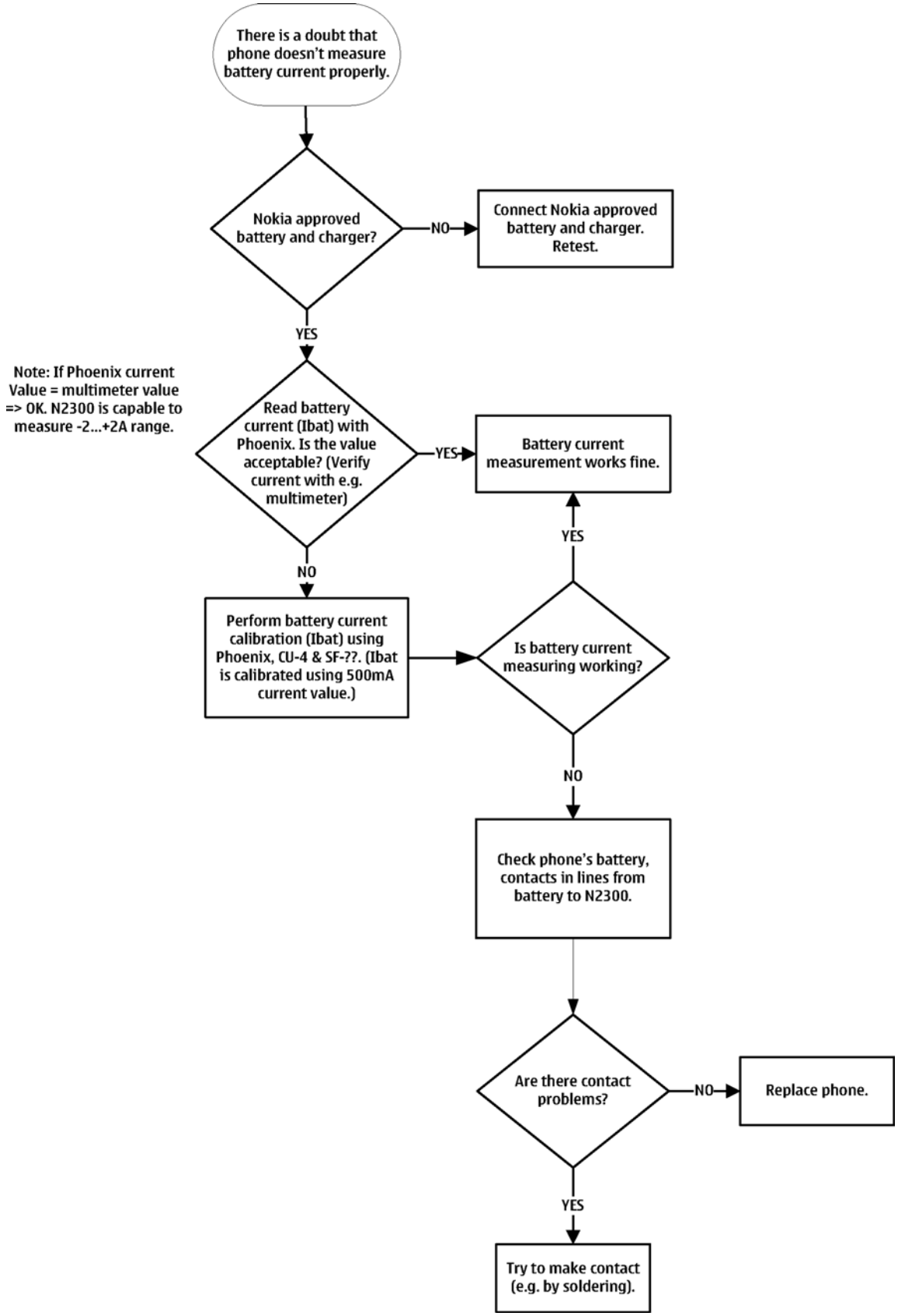
General power checking troubleshooting

Troubleshooting flow



Battery current measuring fault troubleshooting

Troubleshooting flow



Flash programming fault troubleshooting

Troubleshooting flow

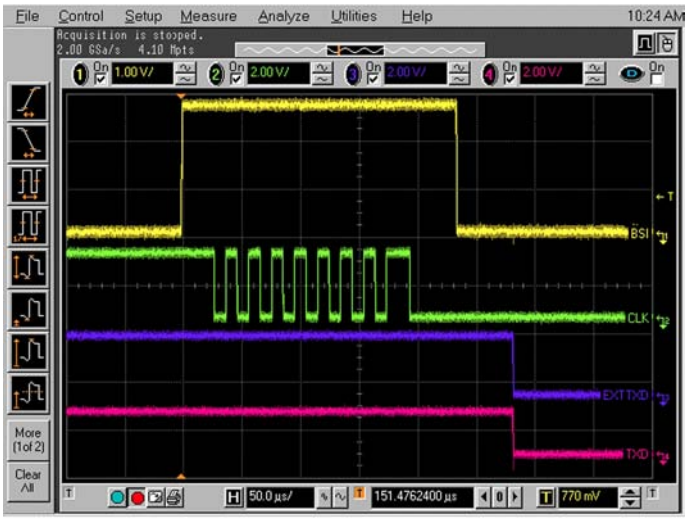


Figure 34 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

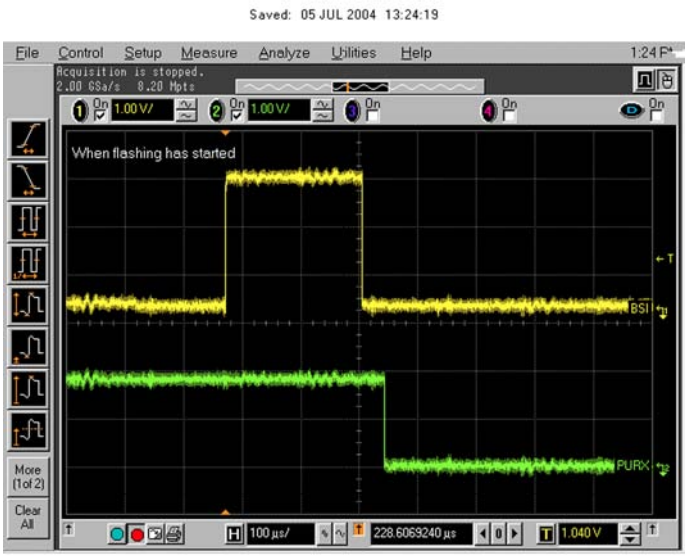


Figure 35 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

Keyboard troubleshooting

Context

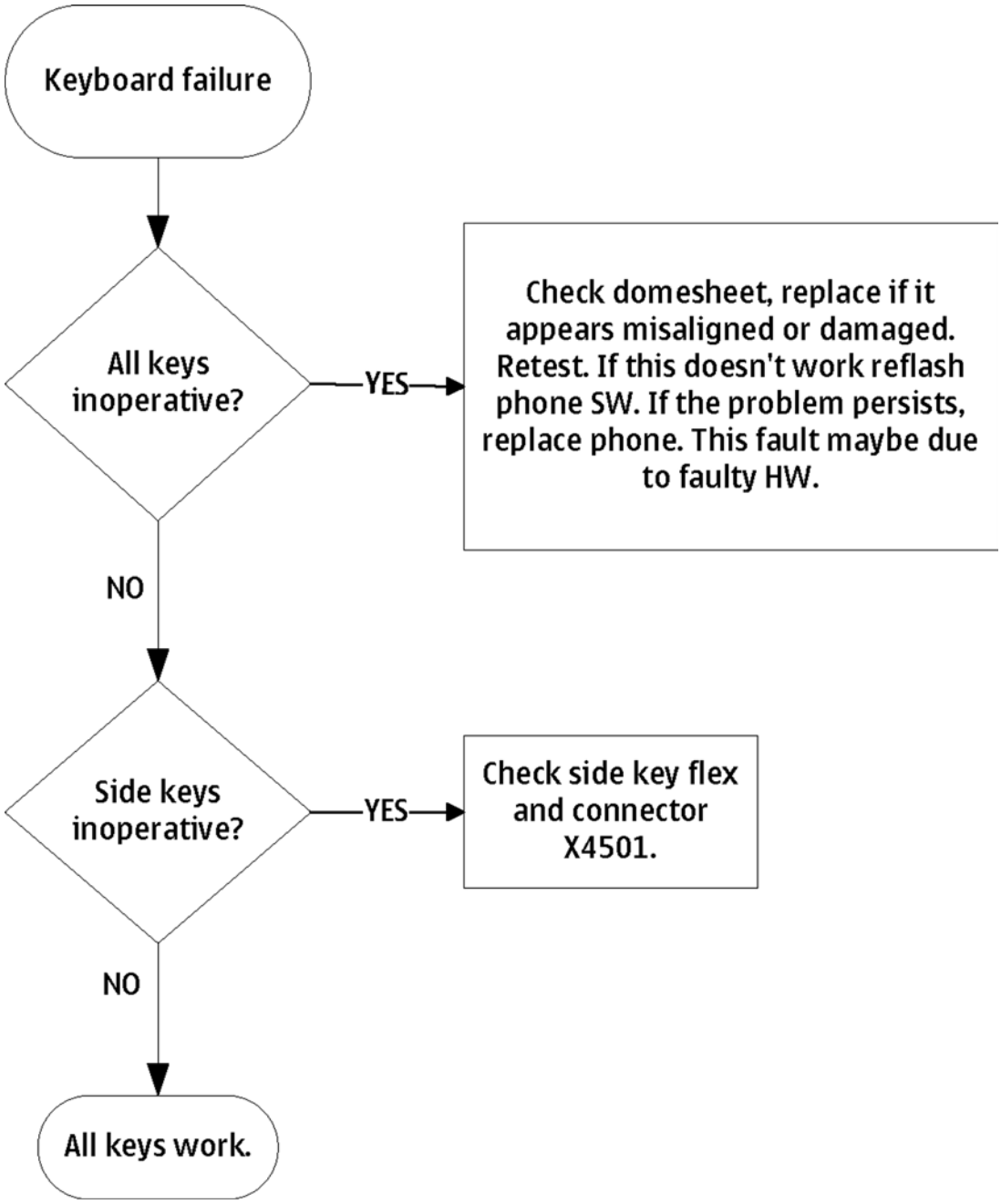
There are two possible failure modes in the keyboard module:

- One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, corrosion).

- Malfunction of several keys at the same time; this happens when one or more rows or columns are faulty (shortcut or open connection). For a more detailed description of the keyboard and keymatrix, see section **Keyboard** in **System Module**.

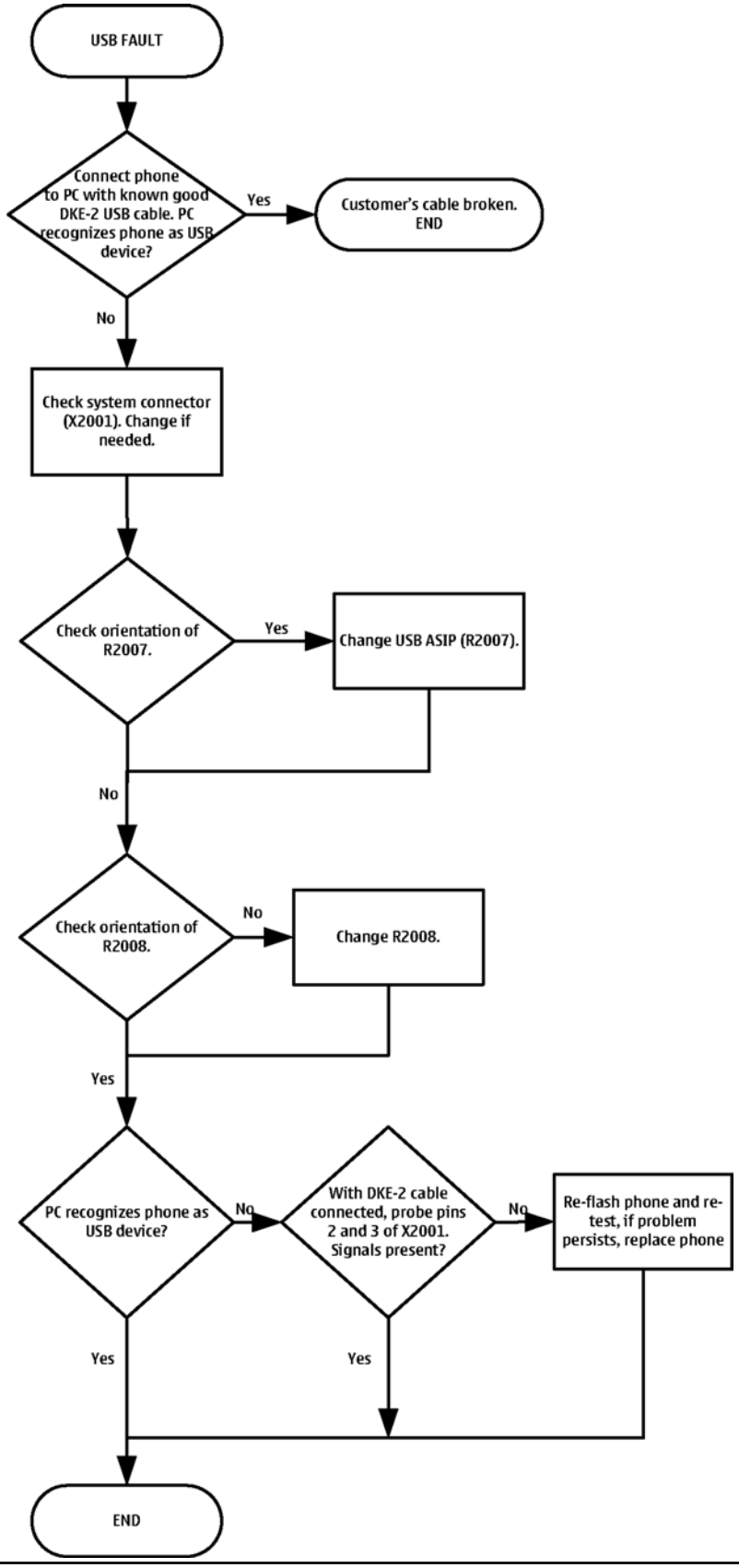
If the failure mode is not clear, start with the **Keyboard Test** in *Phoenix*.

Troubleshooting flow



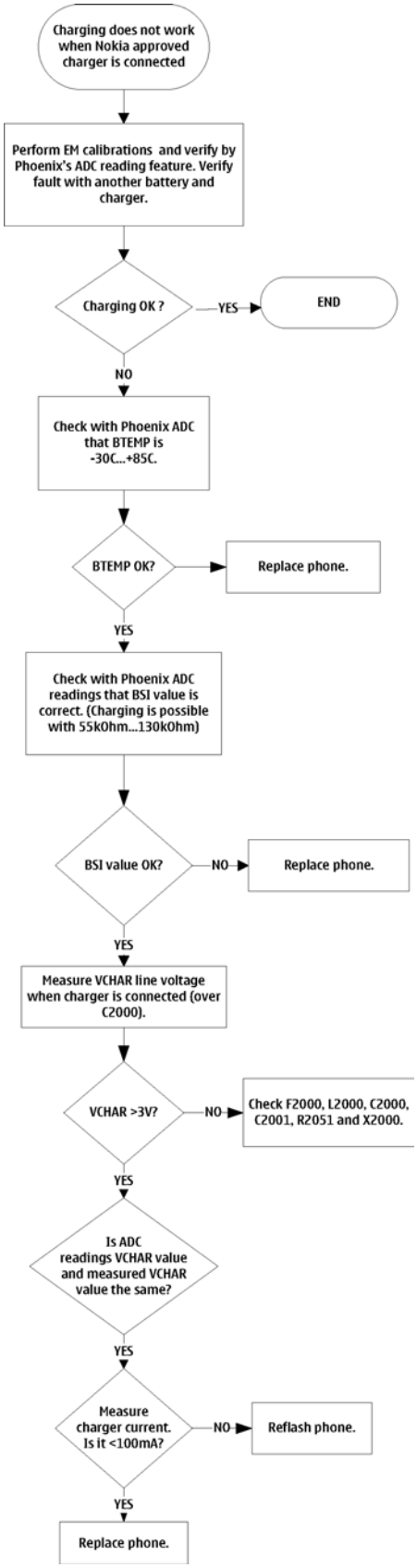
USB interface troubleshooting

Troubleshooting flow



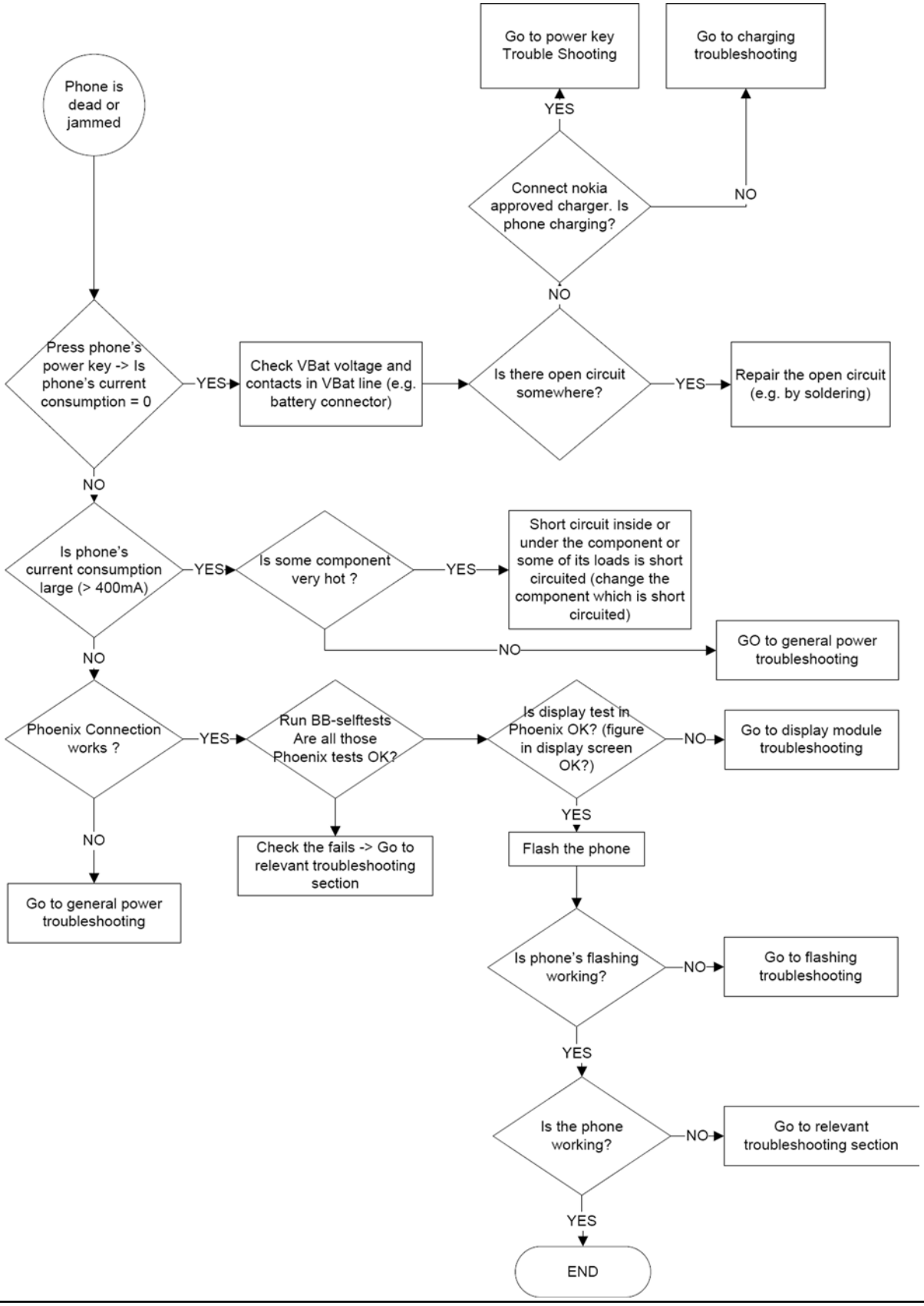
Charging troubleshooting

Troubleshooting flow



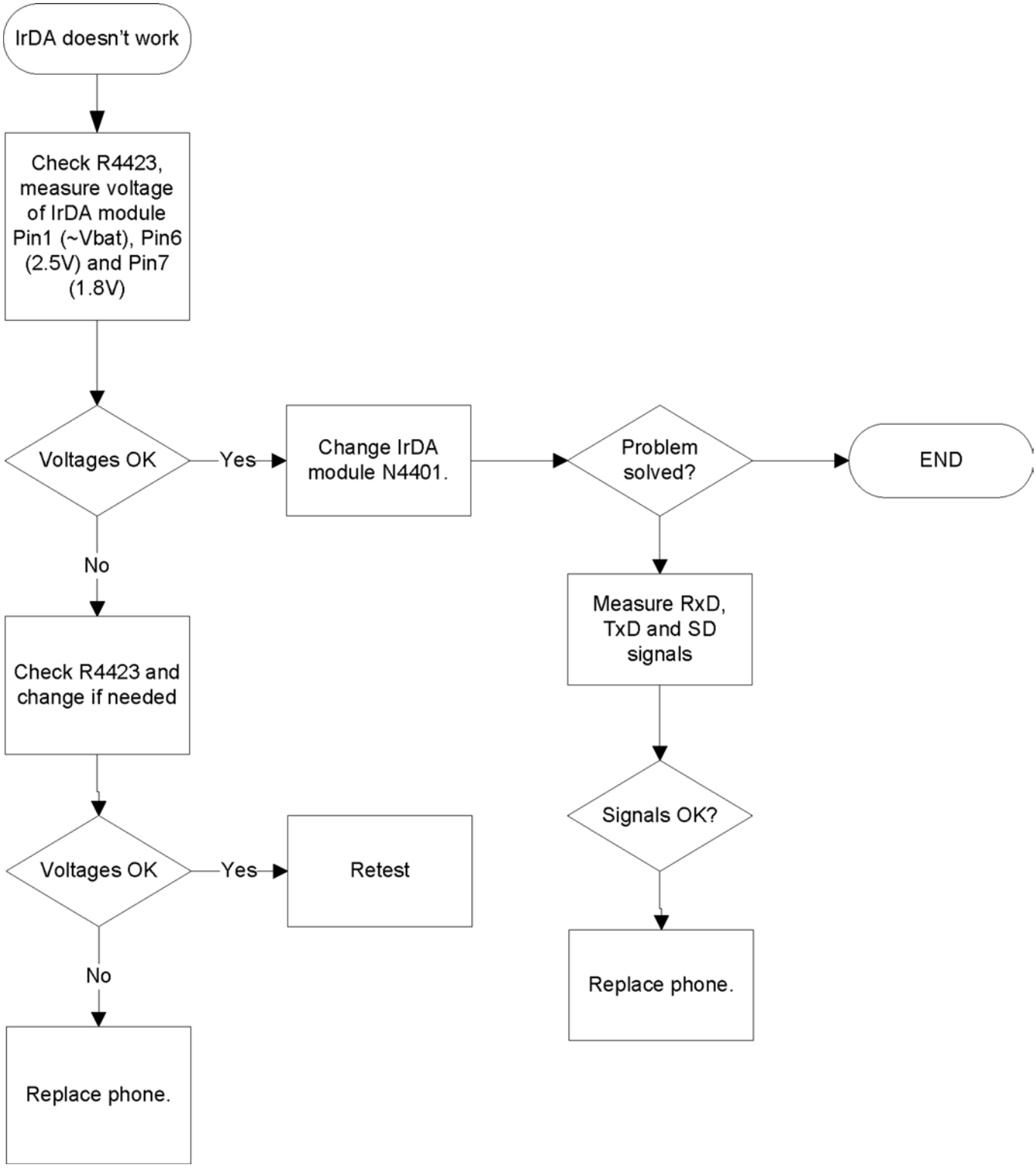
Dead or jammed troubleshooting

Troubleshooting flow



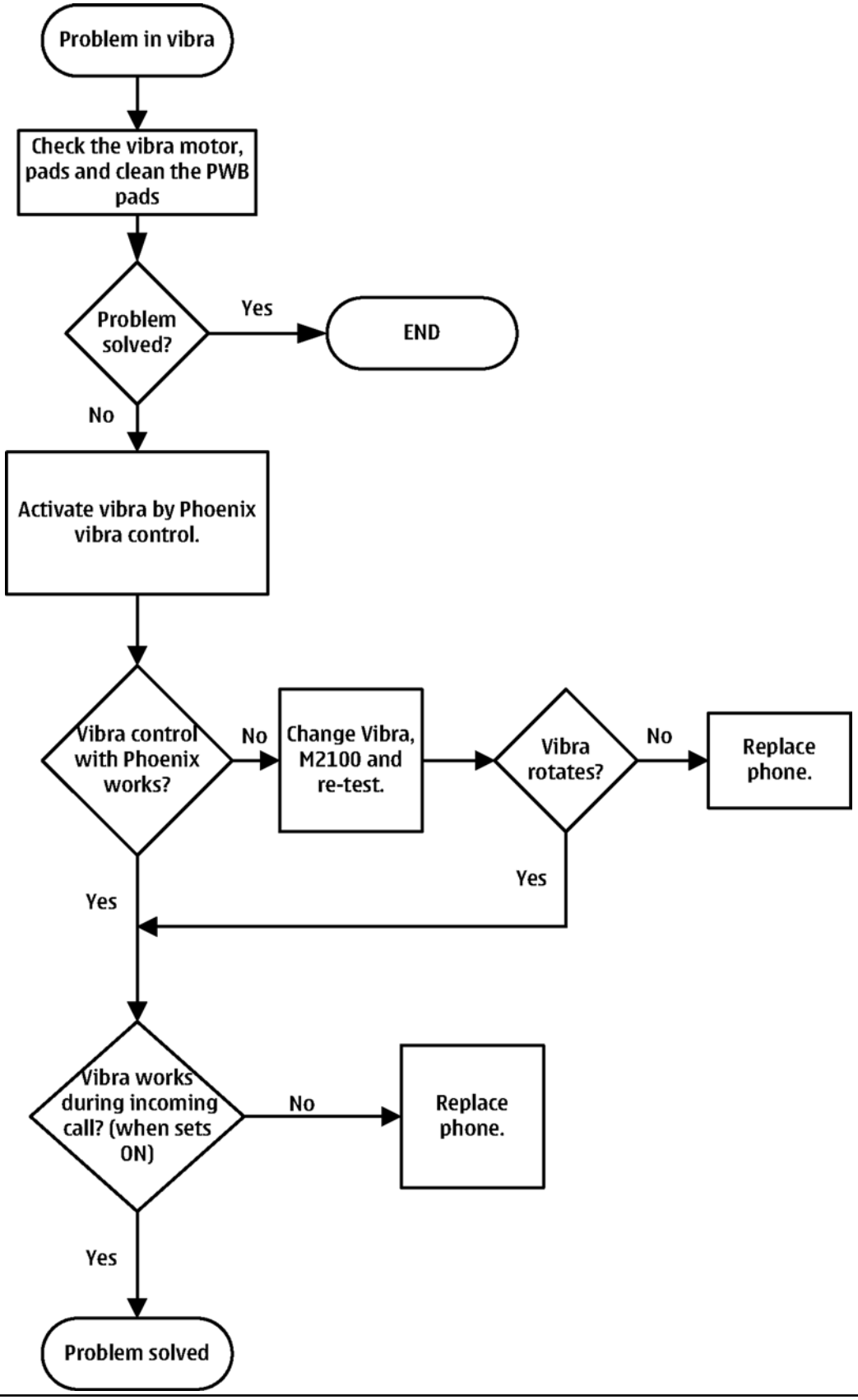
IrDA troubleshooting

Troubleshooting flow



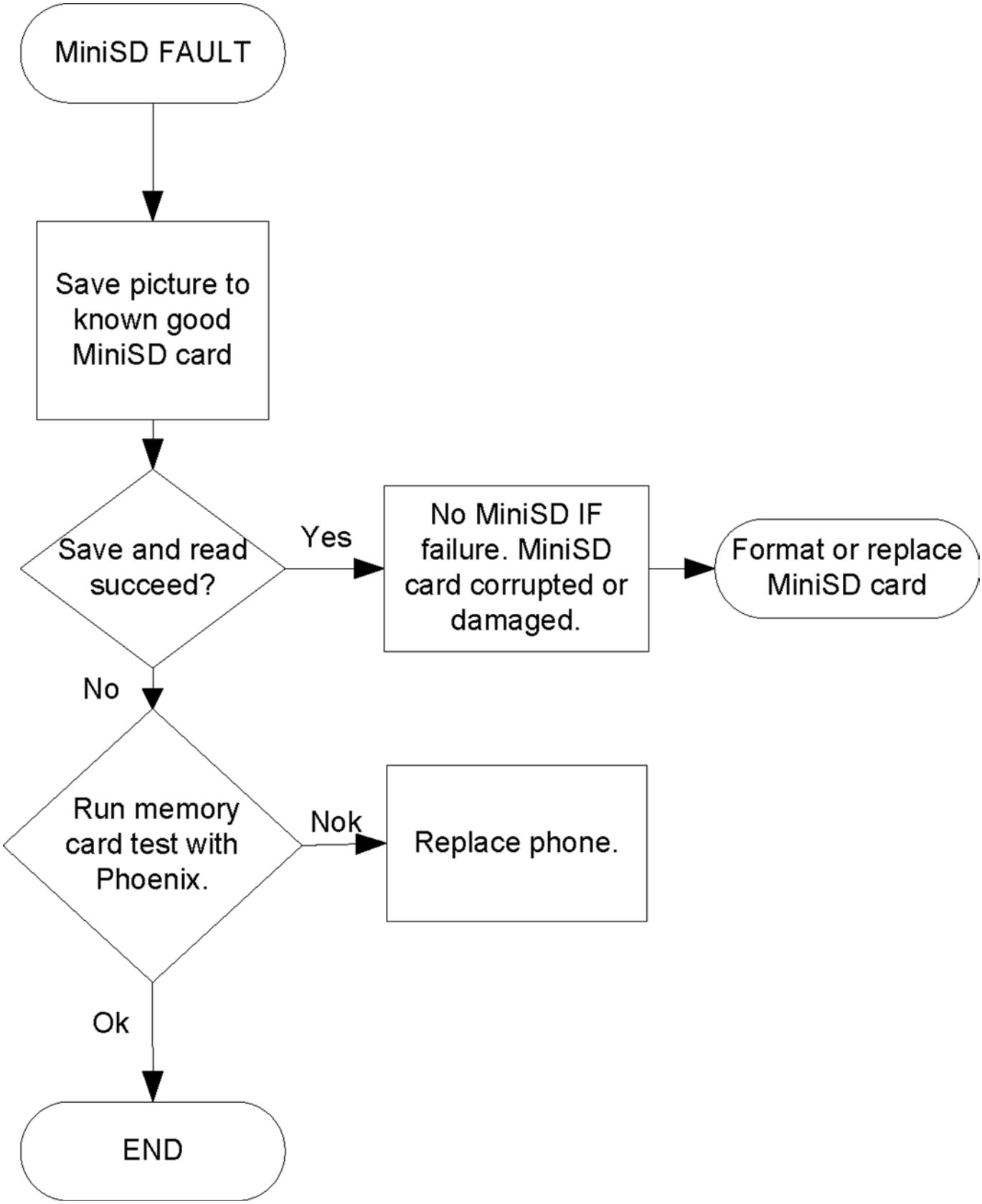
Vibra troubleshooting

Troubleshooting flow



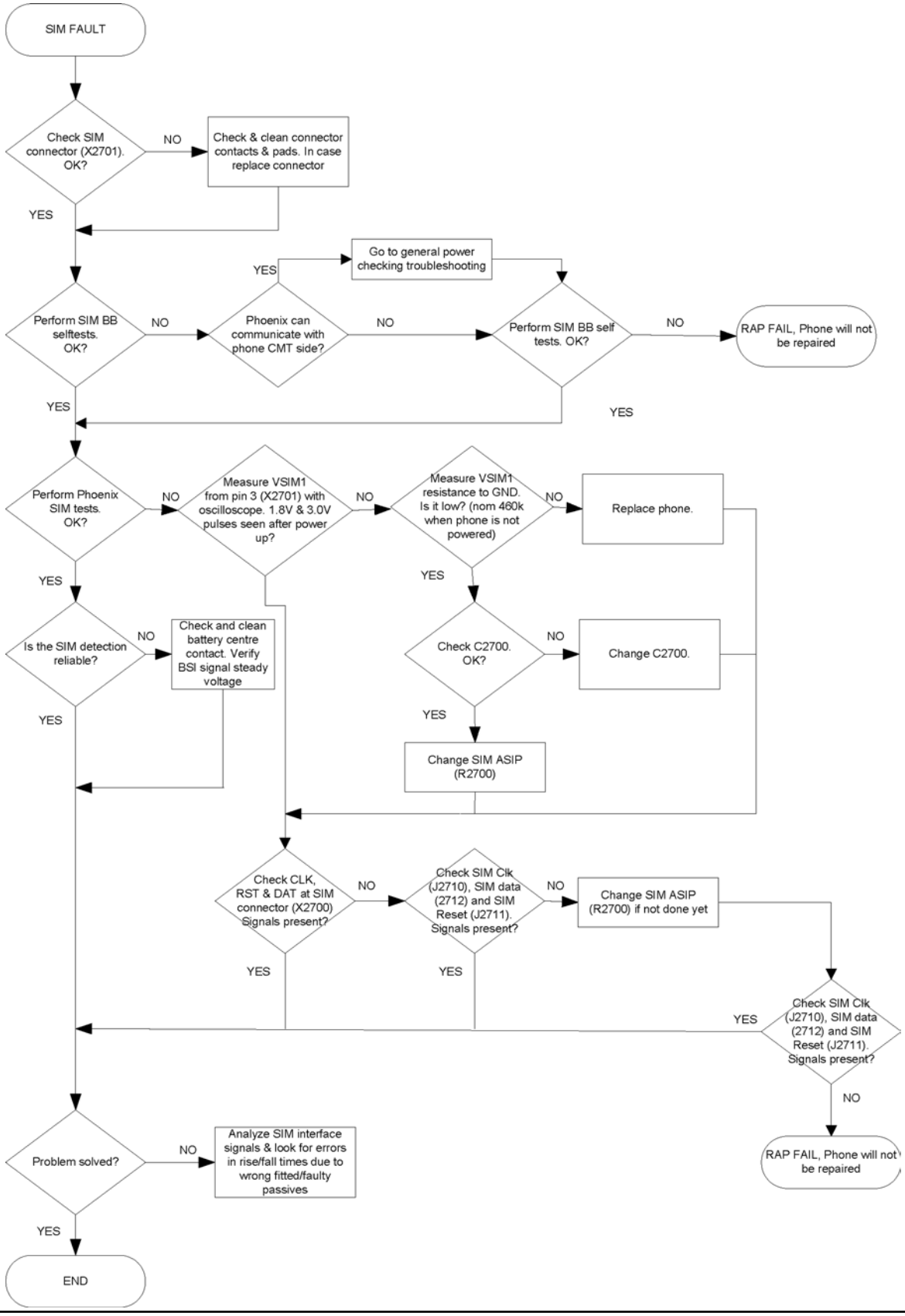
MiniSD troubleshooting

Troubleshooting flow



SIM troubleshooting

Troubleshooting flow



Display module troubleshooting

General instructions for display troubleshooting

The first step is to verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.

The second step is to check that the cellular engine is working normally. This can be done by connecting the phone to a docking station and starting Phoenix service software. With the help of Phoenix read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

After these checks proceed to the display troubleshooting flowcharts. Use the Display Test tool in Phoenix to find the detailed fault mode.

Operating modes of the display

The display is in a normal mode when the phone is in active use.

The display is in a partial idle mode when the phone is in the screen saver mode.

The operating modes of the display can be controlled with the help of Phoenix.

Table 9 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. Backlight is also controlled automatically by the ambient light sensor. This means that in case the display is working (image OK), but the backlight is not, follow the Display and Keyboard Backlight troubleshooting.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

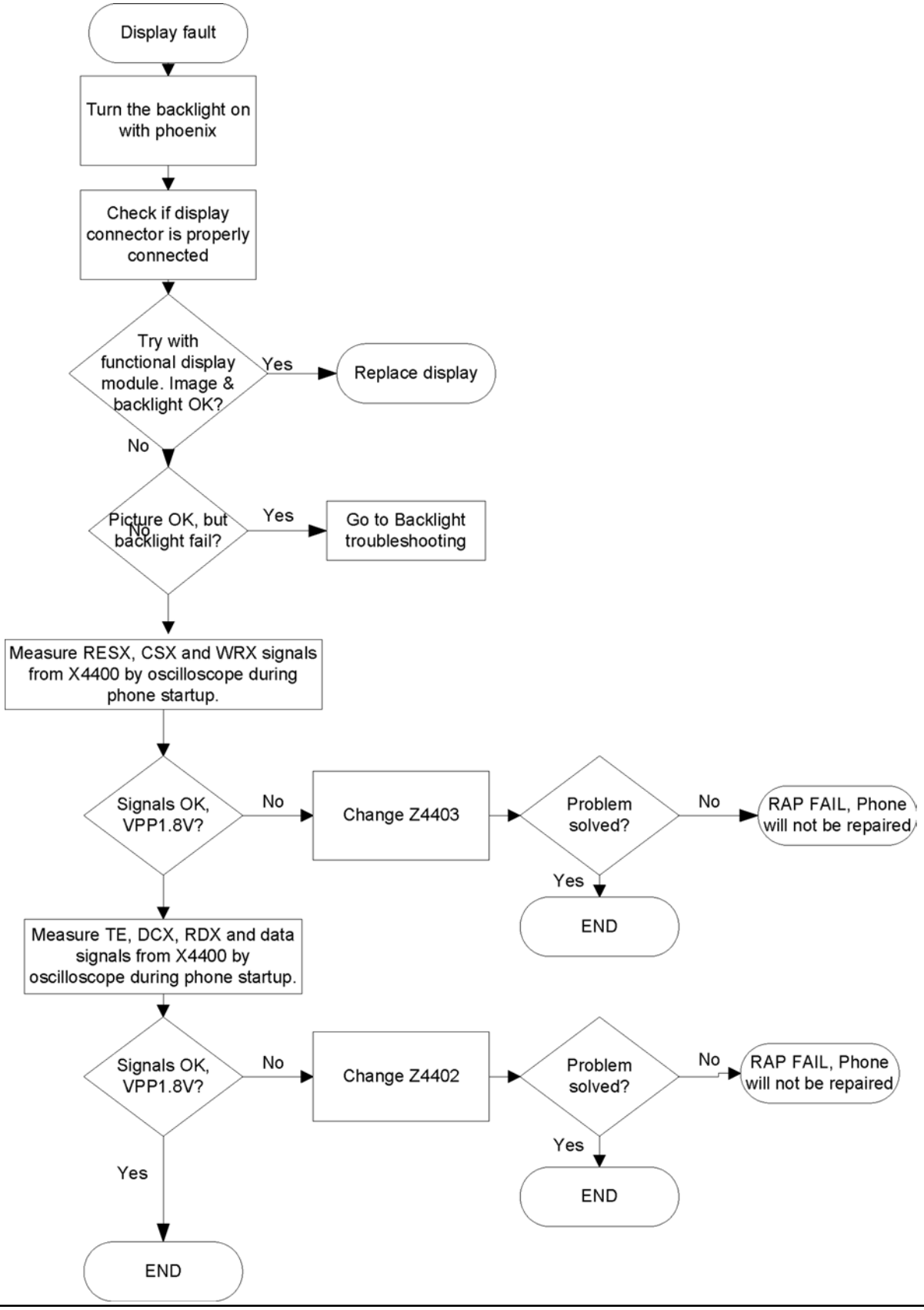
Table 10 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Note: Blinking pixels are not allowed in normal operating temperatures and light conditions.

Display fault troubleshooting

Troubleshooting flow



Display and keyboard backlight troubleshooting

Context

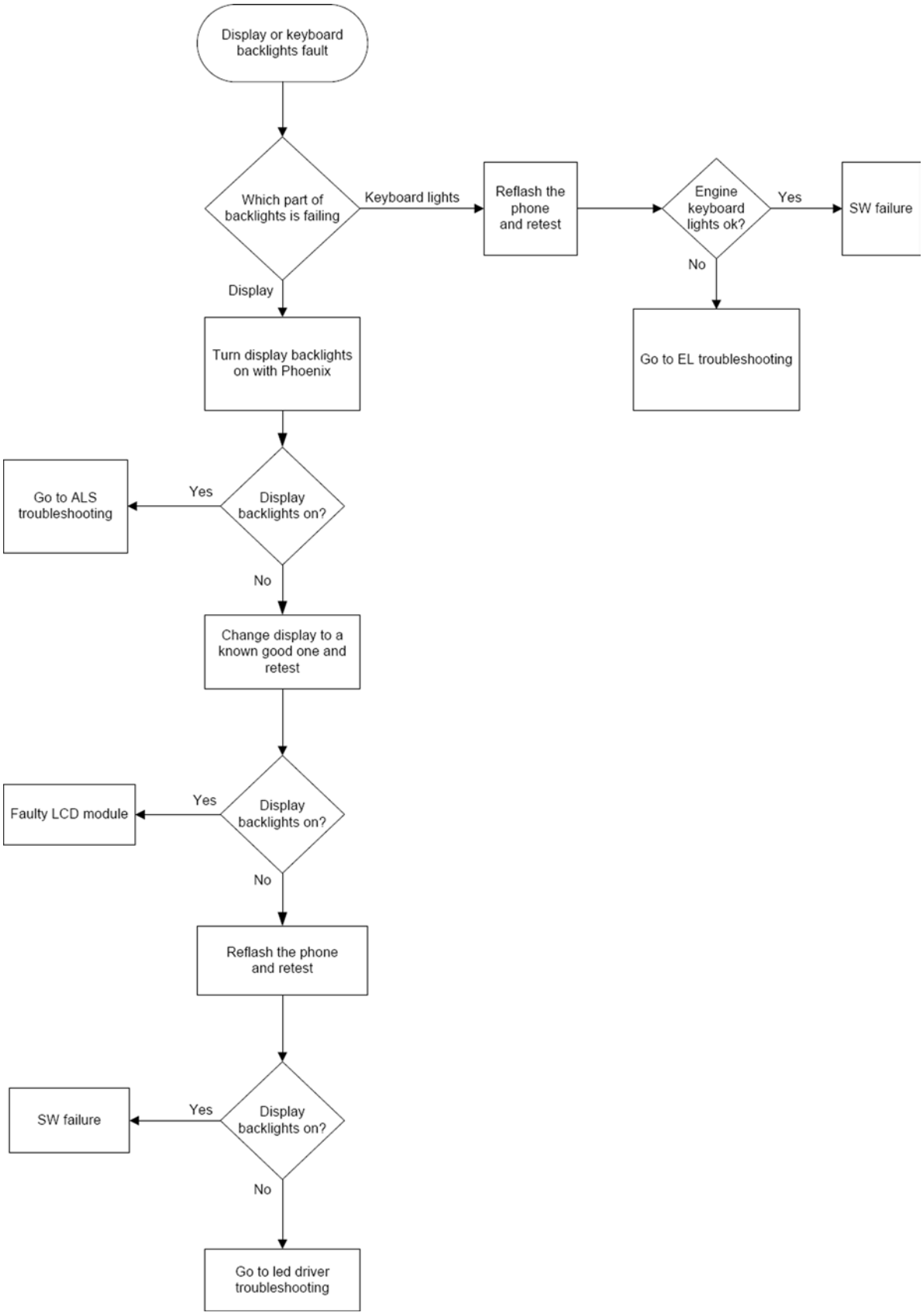
The device has one LED driver that provides current for the display backlight.

The brightness of the display is adjusted by the Ambient Light Sensor (ALS).

You can enable/disable ALS with the help of Phoenix service software.

Display brightness can be adjusted manually, if ALS is disabled. If the ambient light sensor is enabled, it adjusts the display brightness automatically.

Troubleshooting flow

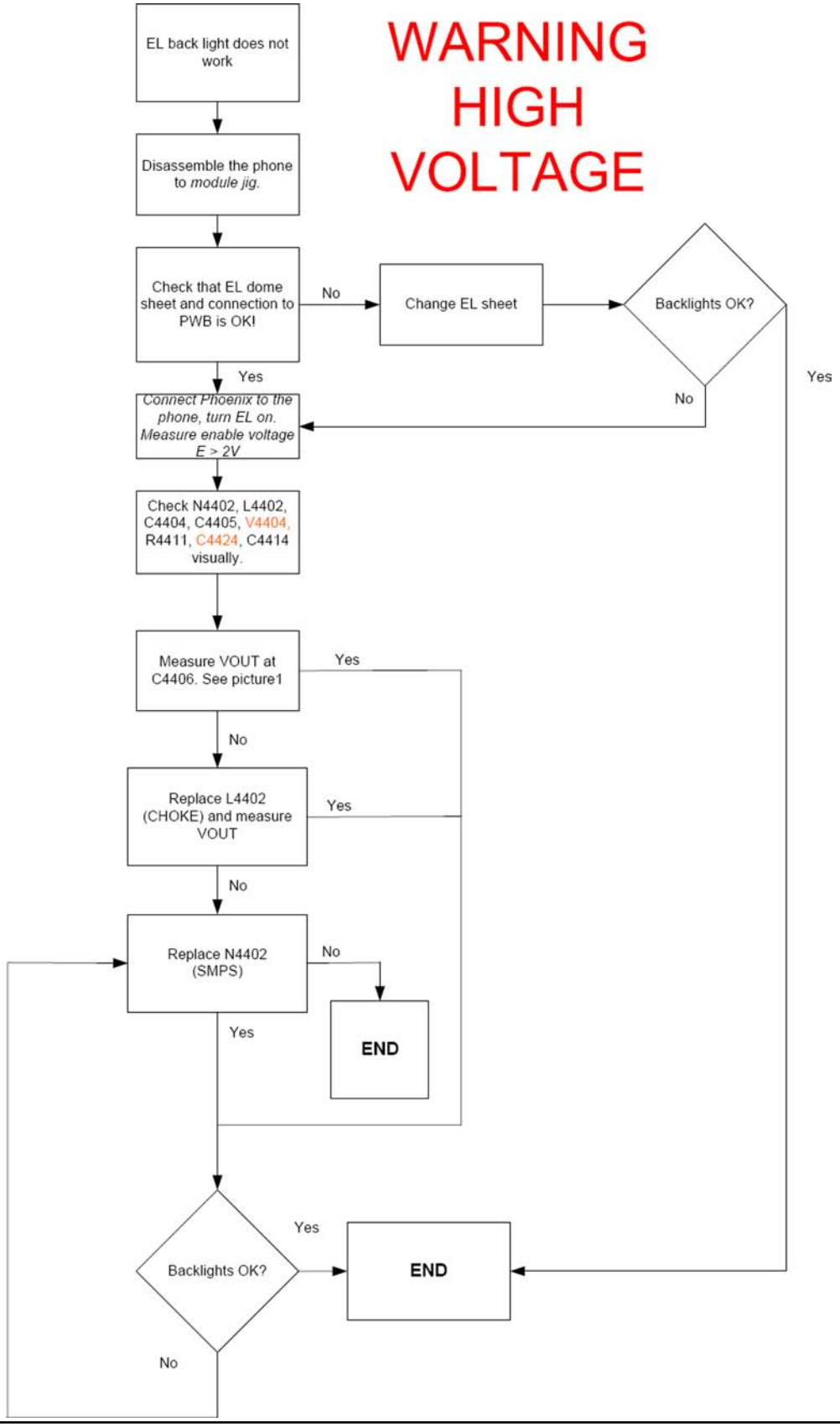


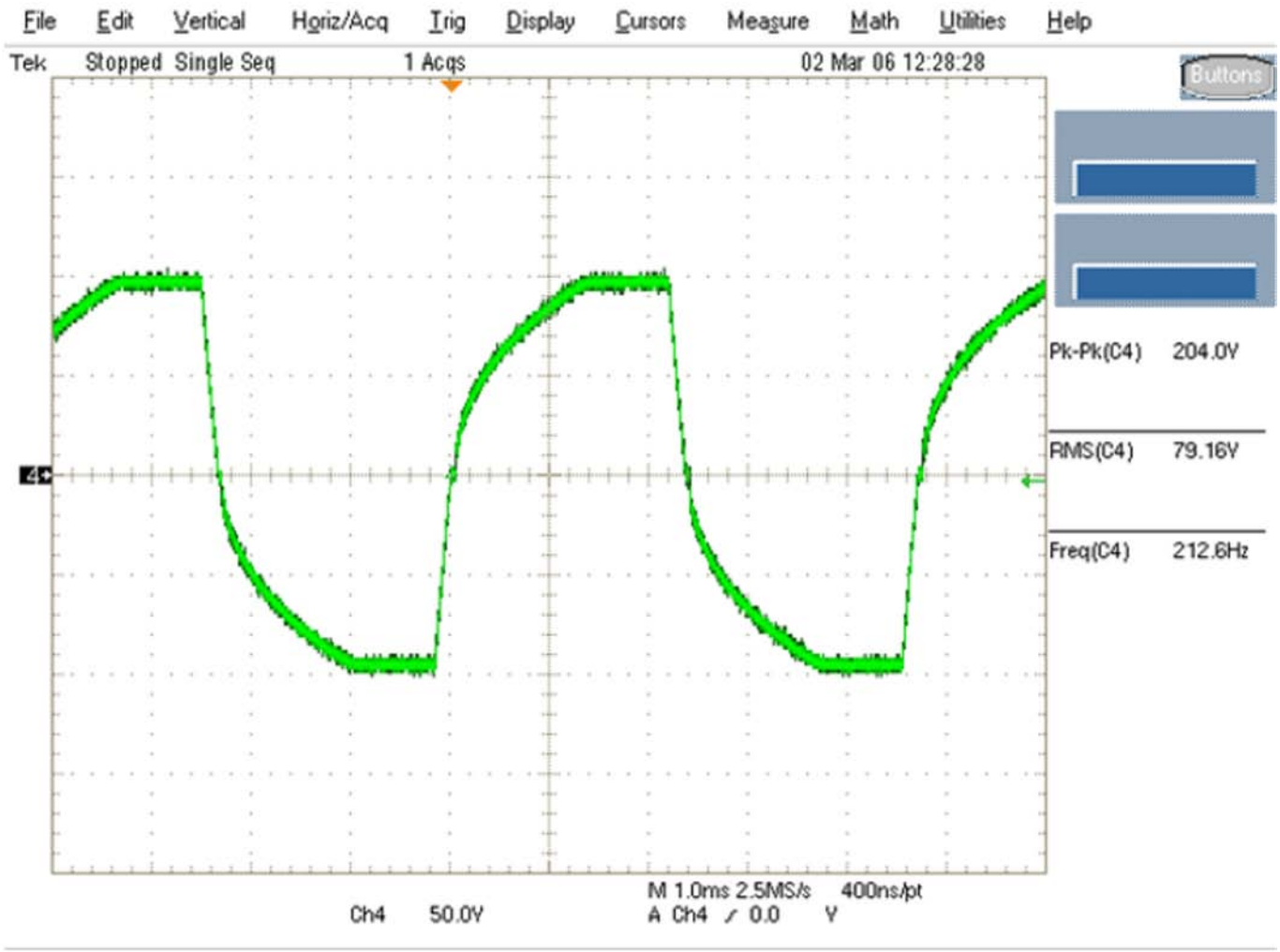
Related information

- Display fault troubleshooting (page 6–20)
- LED driver troubleshooting (page 6–28)
- ALS troubleshooting (page 6–25)

EL backlight fault troubleshooting

Troubleshooting flow





ALS troubleshooting

Context

- If a phototransistor is broken, replace it with a typical phototransistor.
- After replacing the phototransistor or if calibration values are lost for some other reason, ALS re-tuning is required.
- Before starting the ALS calibration procedure, perform the 'Pull-up resistor calibration' in dark lighting conditions, and write the measured 'correction' value to the phone. After this ALS calibration procedure is performed, and the default co-efficient value '1' is written to the phone.
- Make sure that you have completed **Display and keypad backlight troubleshooting** first before starting **ALS troubleshooting**.

Here are some hints for ALS troubleshooting; the following troubleshooting diagram refers to these:

- *Phoenix* LED control tool also shows you luminance. The correct luminance in darkness is <20 lx, and in office environment 100-2000 lx. The luminance value depends strongly on the light source and the angle of the phone, so these values are only a rough guideline.
- LED driver control voltage measurement points can be found from the **LED driver troubleshooting** section. When backlight brightness is set to 100%, both GENOUT signals are low, and enable PWM is 100%.
- *Phoenix* has an ambient light sensor calibration tool for changing calibration values. The pull-up resistor calibration is done first. See the following procedure.

Steps

1. Cover the light guide (upper part of the A-Cover).
2. Start *Phoenix*.
3. Choose **File→Scan Product.**
4. Choose **Tuning→Ambient Light Sensor Calibration.**

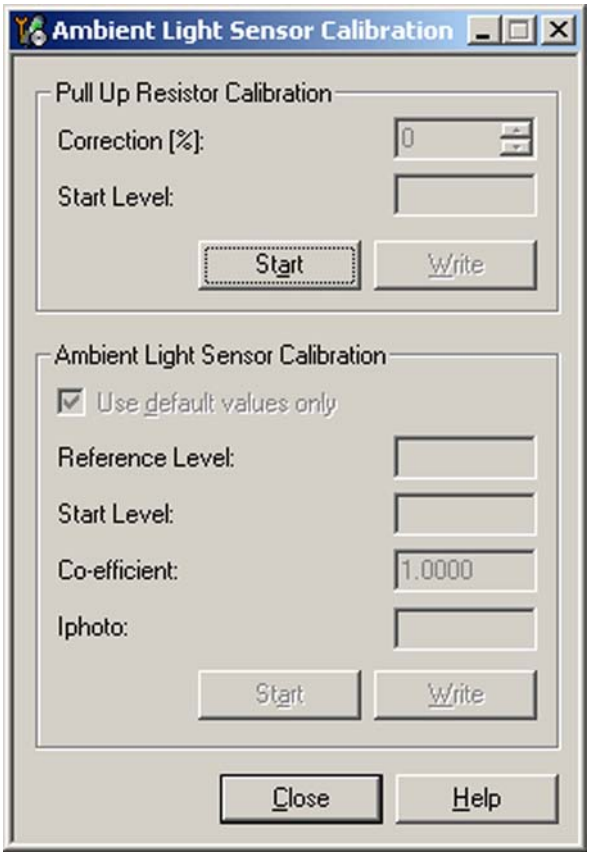
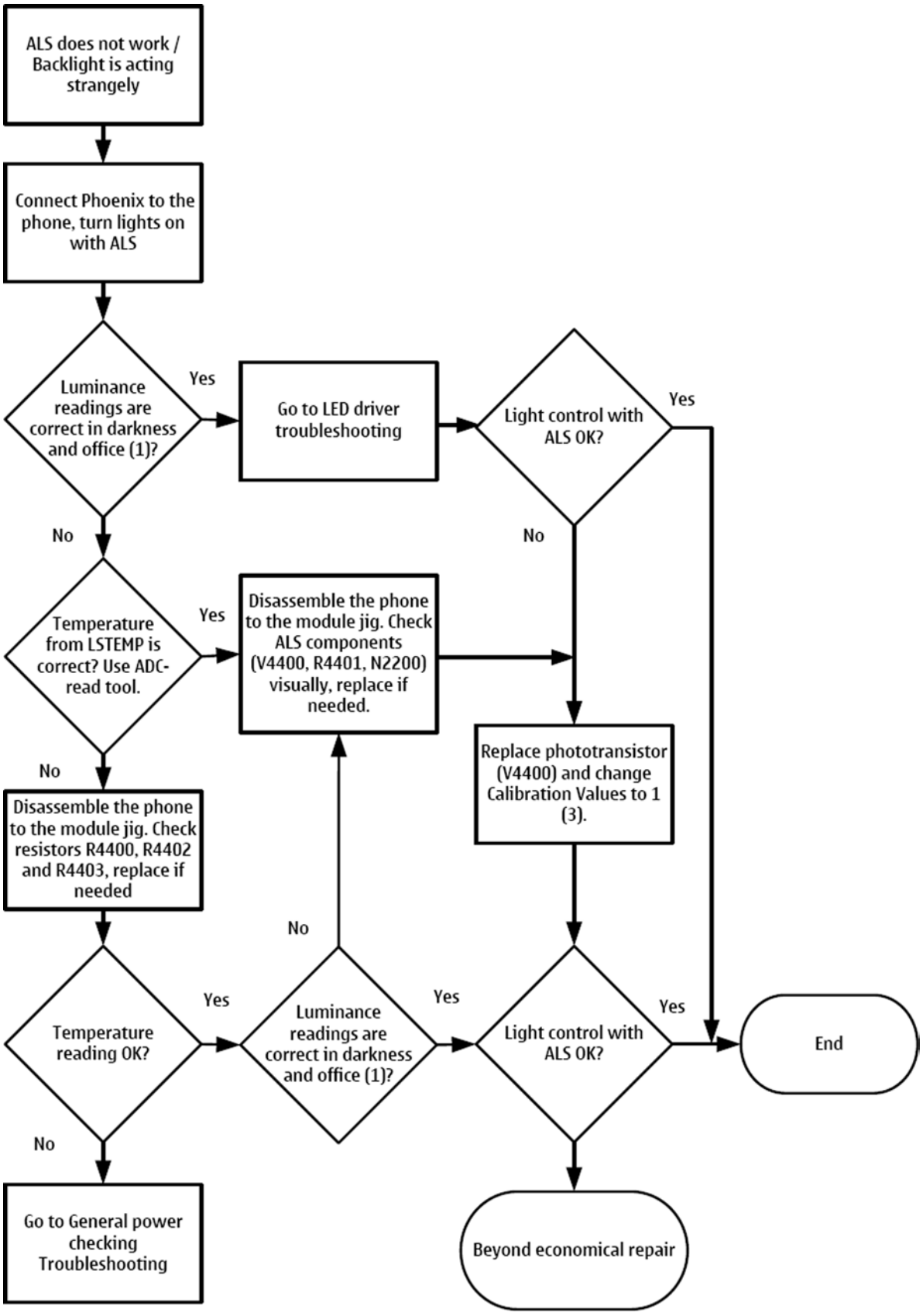


Figure 36 *Ambient Light Sensor Calibration* window

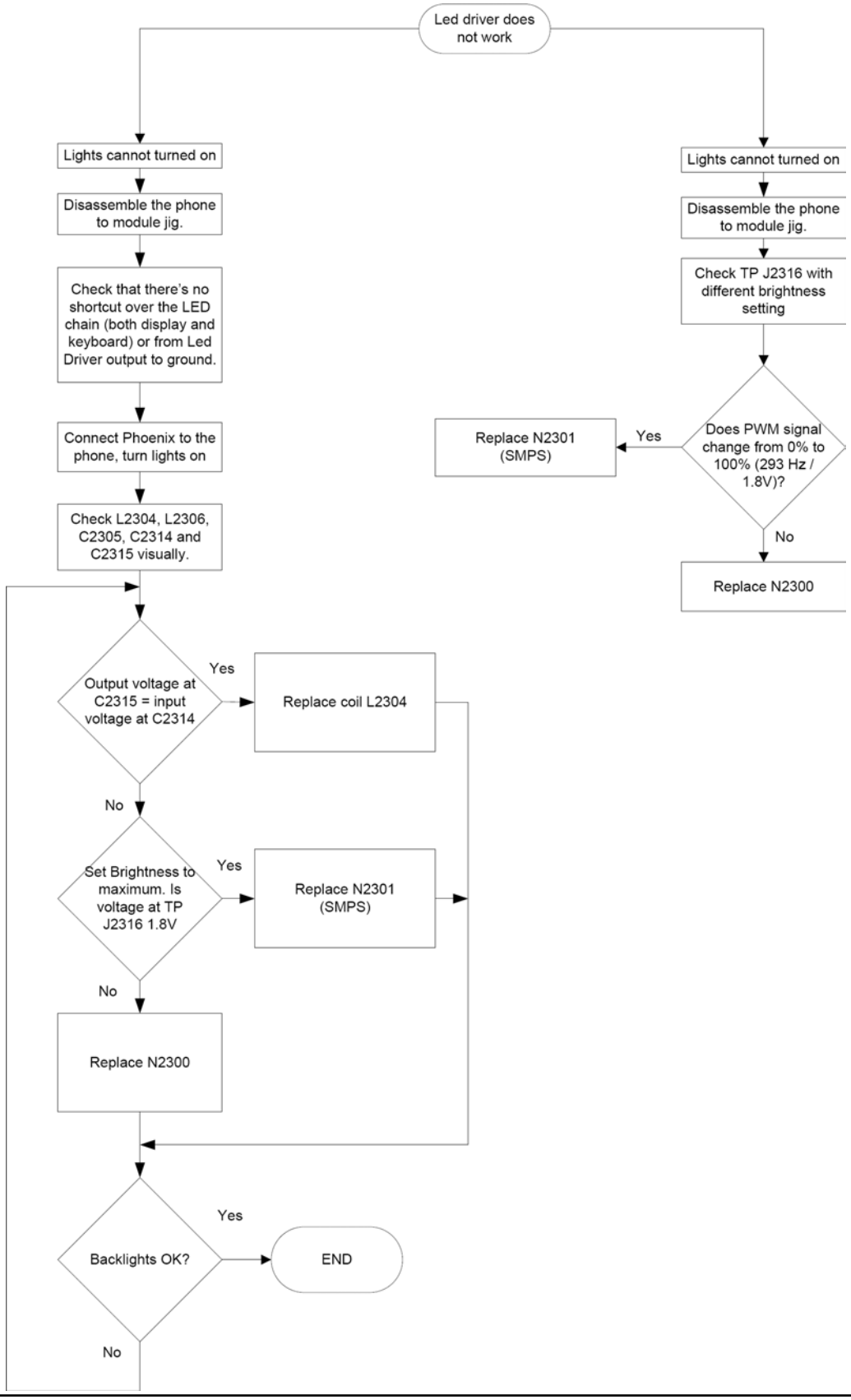
5. In the *Pull Up Resistor Calibration* pane, click **Start**, and **Write**.
6. In the *Ambient Light Sensor Calibration* pane, check the **Use default values only** check box, and click **Write**.
7. To end the calibration, click **Close**.

Troubleshooting flow



LED driver troubleshooting

Troubleshooting flow



Bluetooth troubleshooting

Introduction to Bluetooth troubleshooting

There are two main Bluetooth problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB. (see next page for details about BT antenna HW and Mechanics)
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

Bluetooth settings for Phoenix

Steps

1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.

   In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.

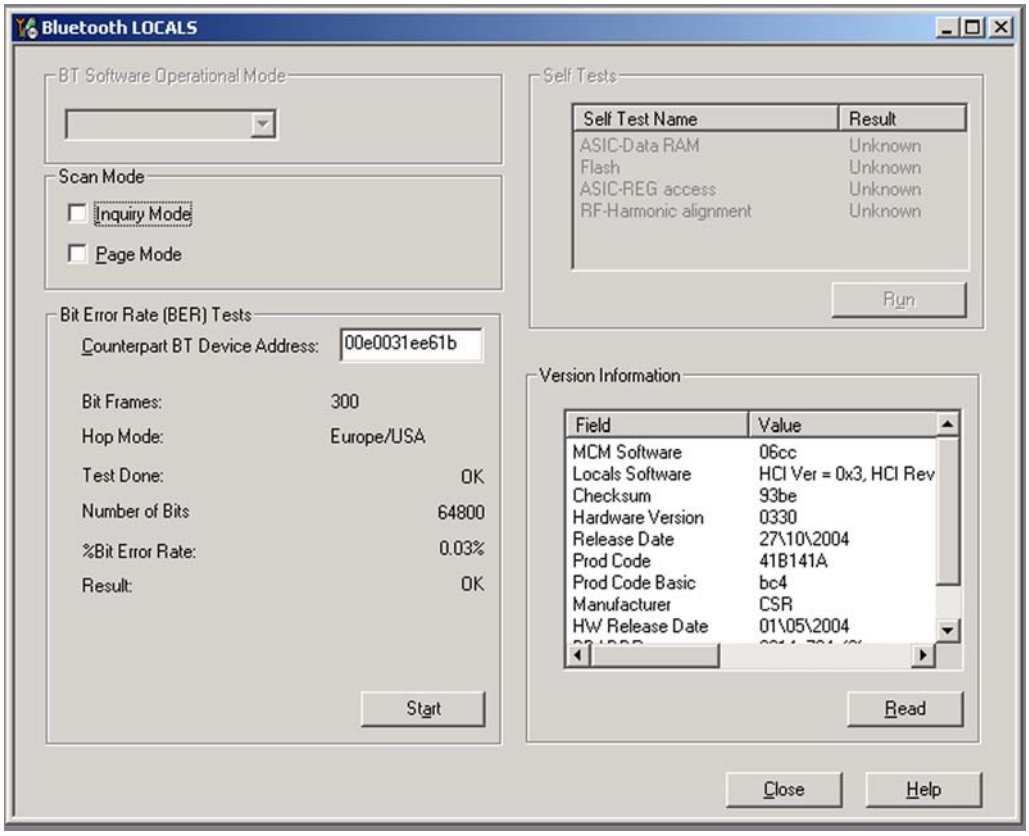


Figure 37 BER test result

Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose**File→Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**
   - **ST_BT_WAKEUP_TEST**

7. To run the tests, click **Start**.

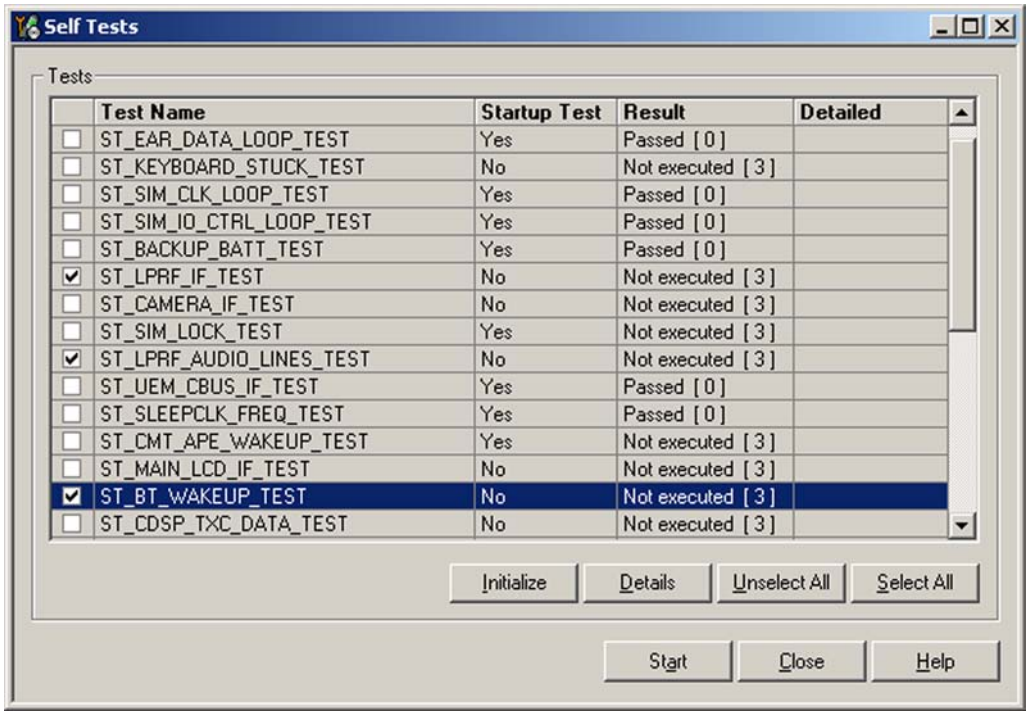
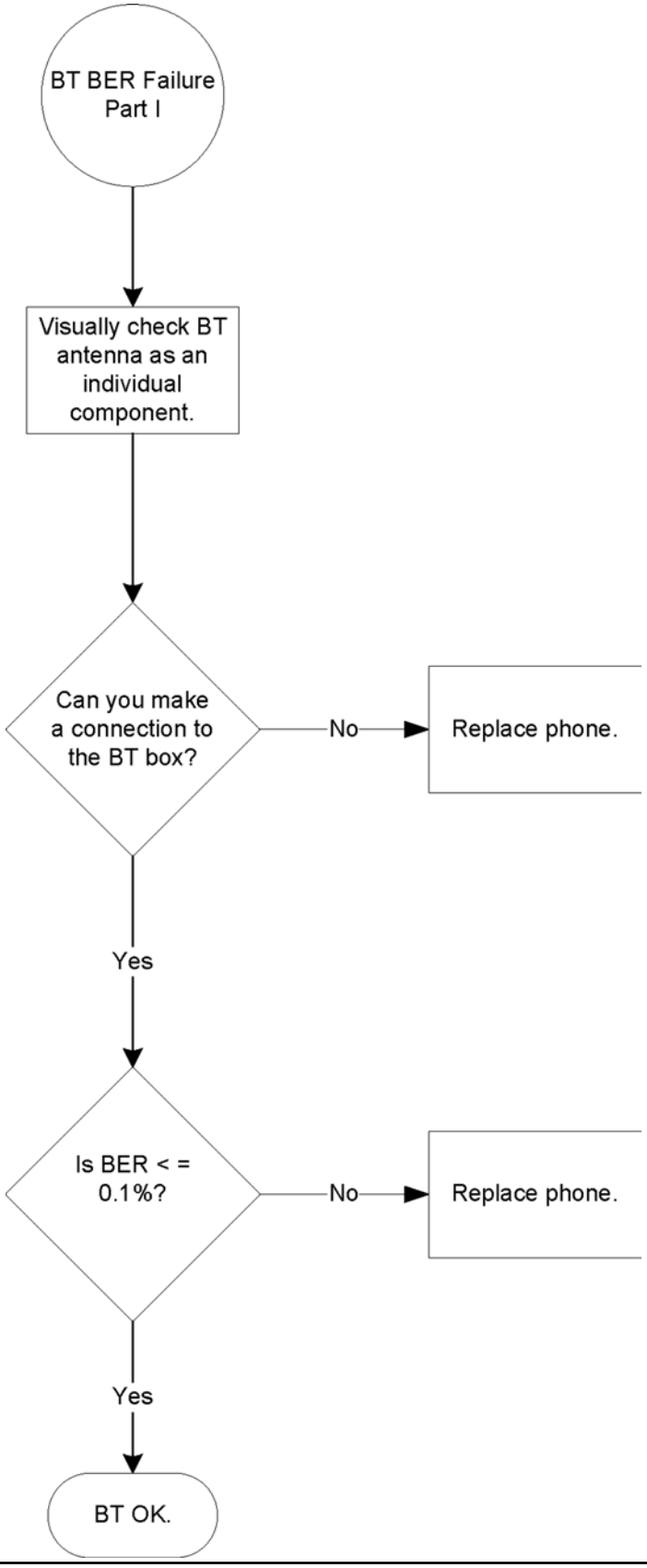


Figure 38 Bluetooth self tests in *Phoenix*

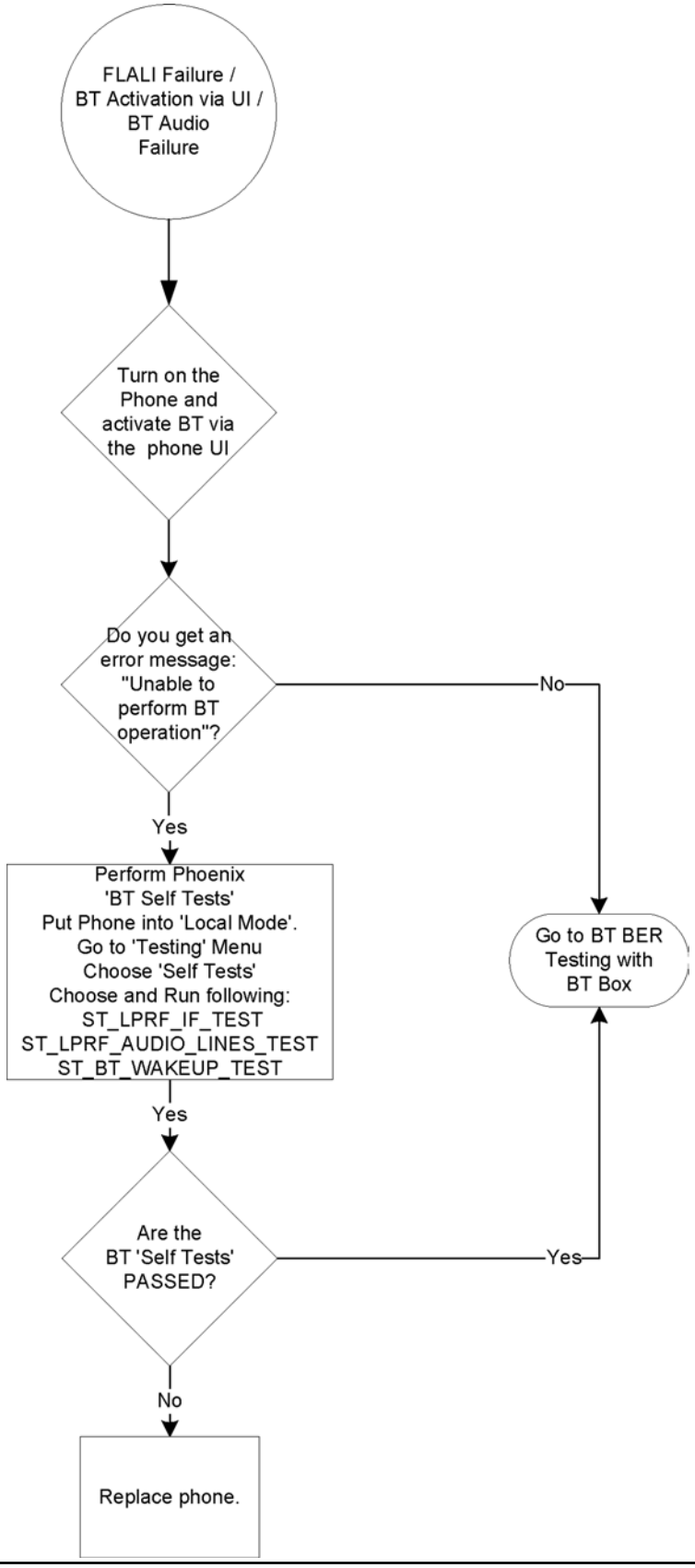
Bluetooth BER failure troubleshooting

Troubleshooting flow



BT audio failure troubleshooting

Troubleshooting flow



Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	35	100	920	1.2	NA
		EarN and GND					

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to Internal Handsfree	XMICP and GND	B2102 pads	32	100	-	0	80mA +/- 10mA
Internal Mic to External Earpiece	B2100 (OUT/ GND)	XEARL and GND	35	100	1360	0	NA
		XEARR and GND					

Measurement data

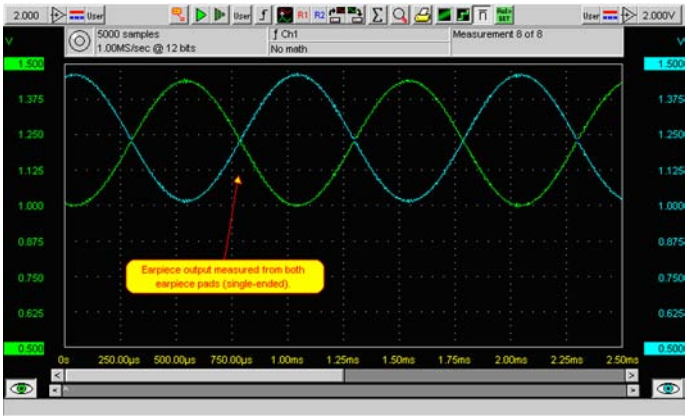


Figure 39 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.

Figure 40 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

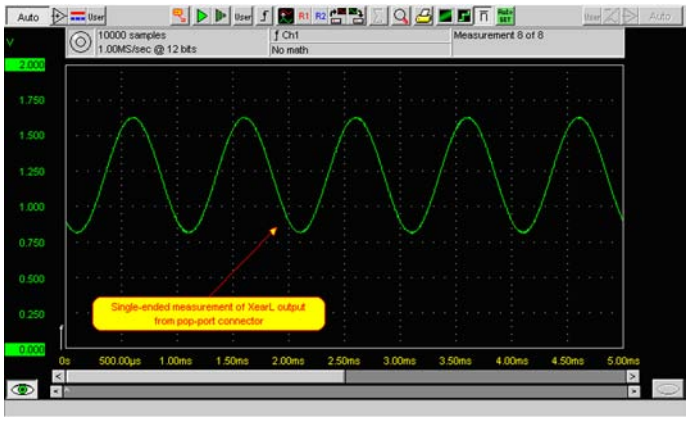
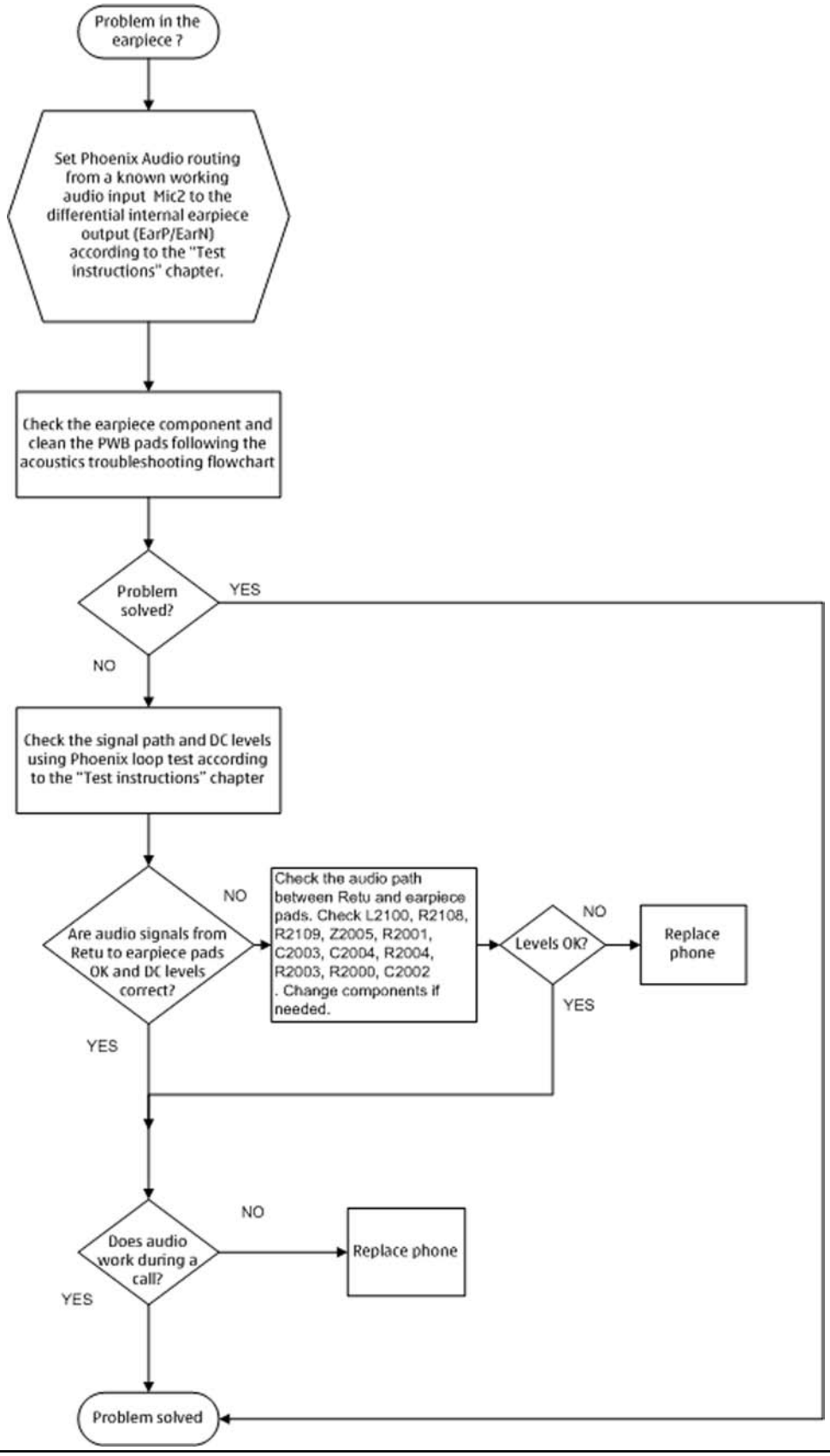


Figure 41 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

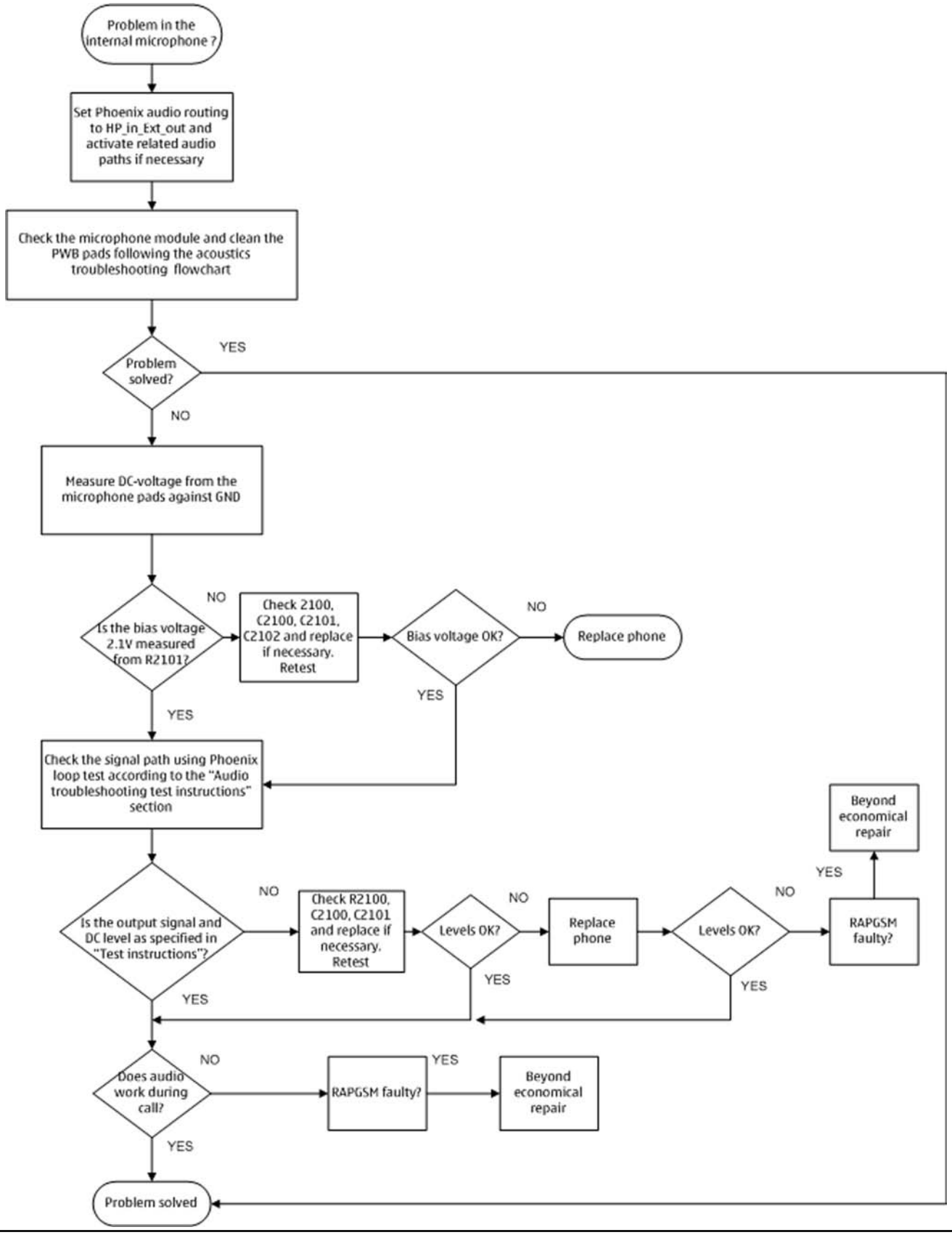
Internal earpiece troubleshooting

Troubleshooting flow



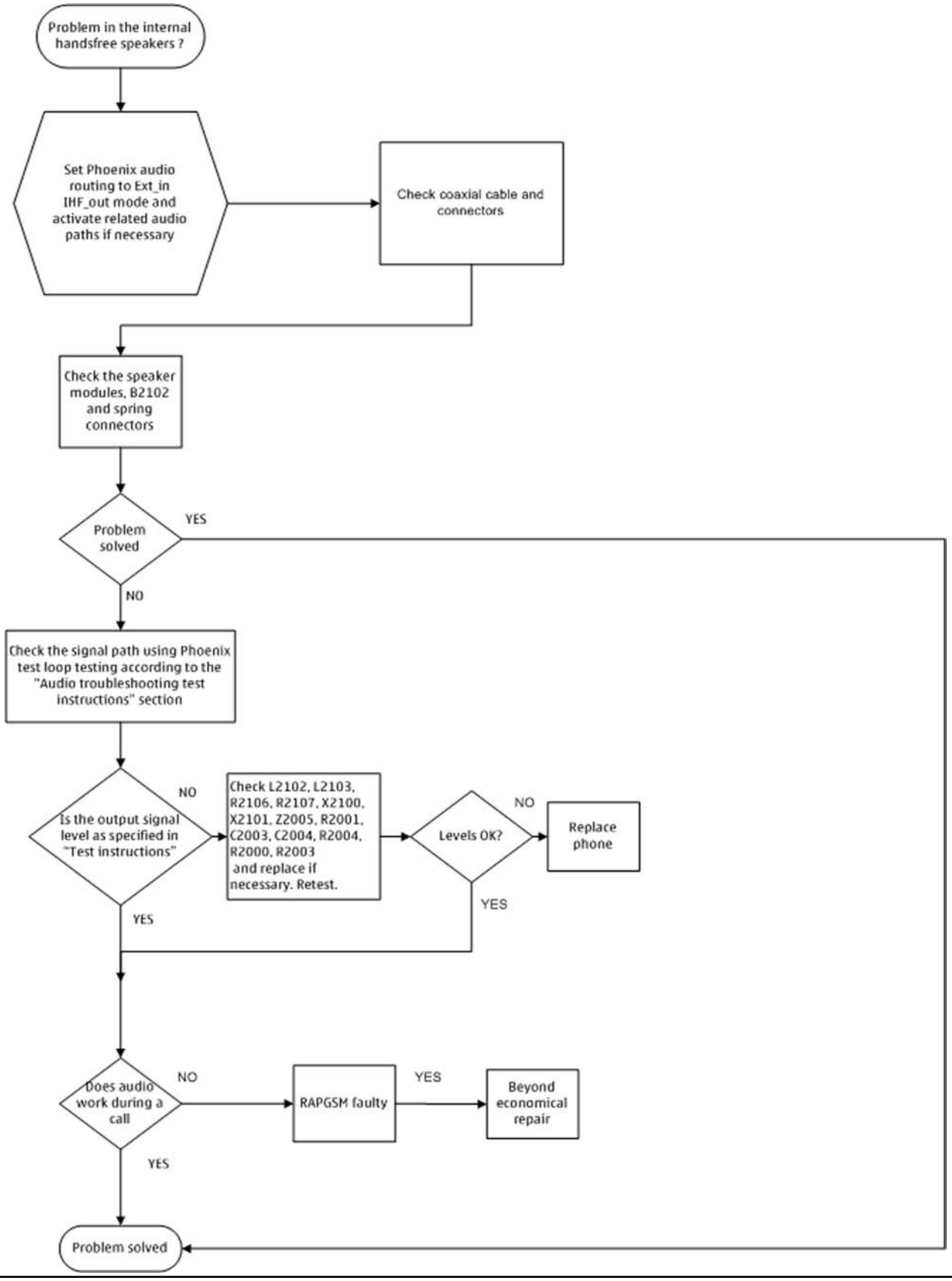
Internal microphone troubleshooting

Troubleshooting flow



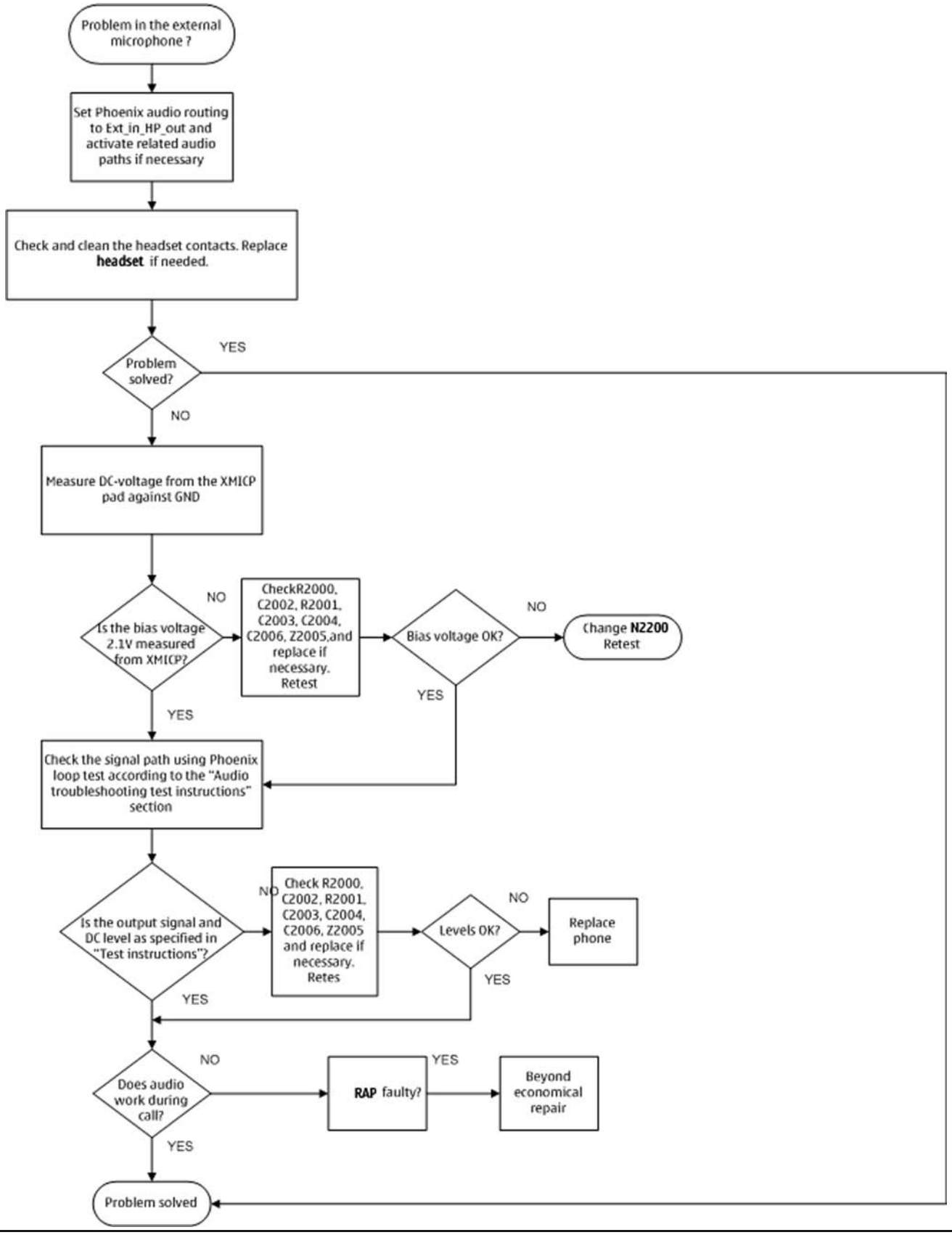
IHF troubleshooting

Troubleshooting flow



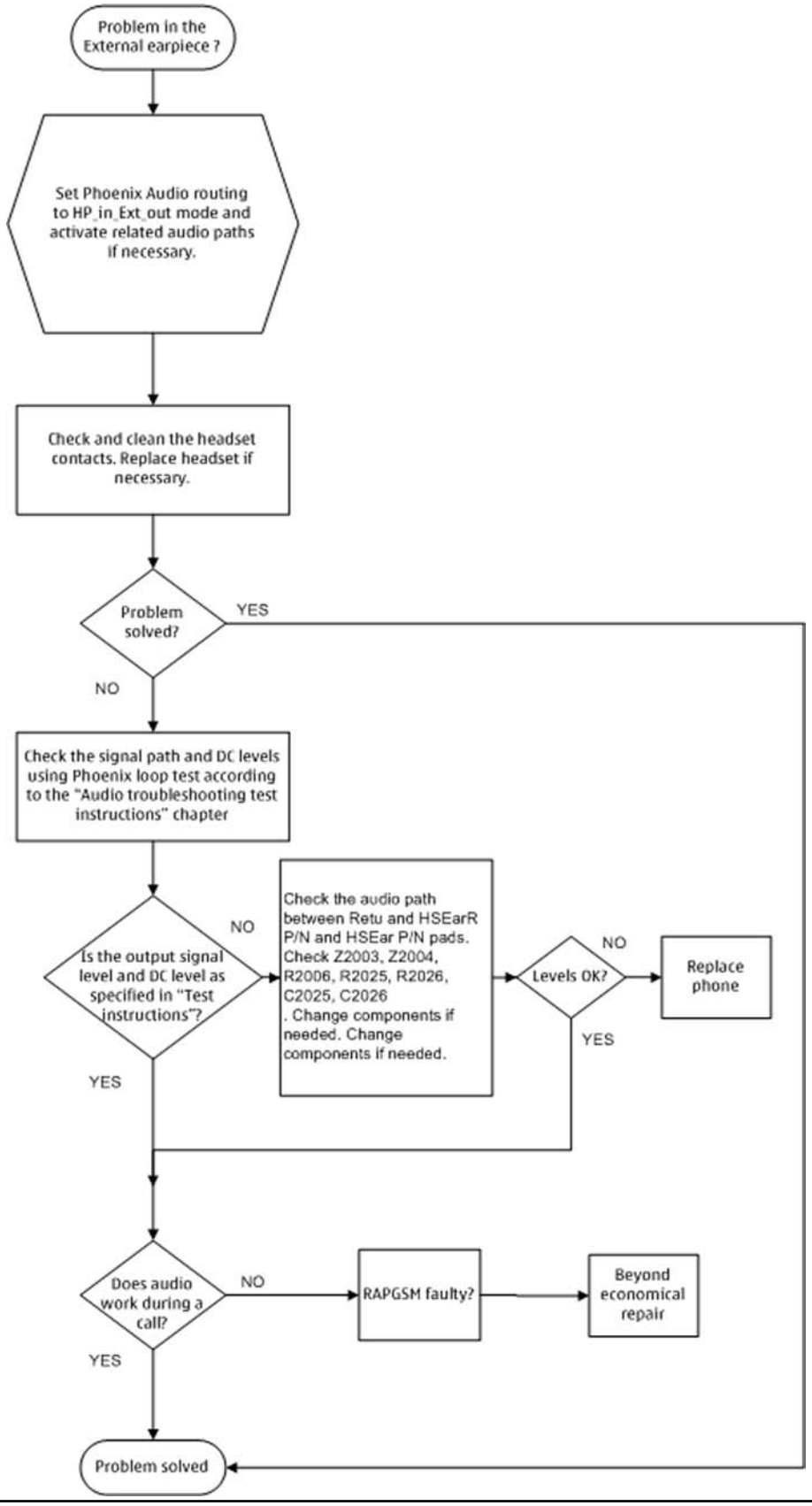
External microphone troubleshooting

Troubleshooting flow



External earpiece troubleshooting

Troubleshooting flow



Introduction to acoustics troubleshooting

Acoustics troubleshooting

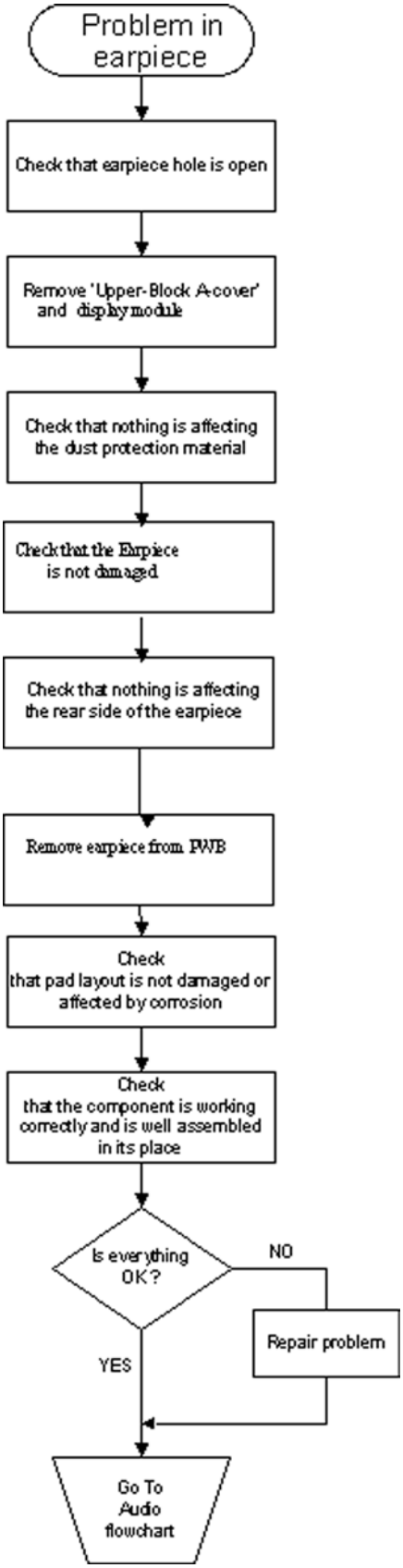
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by speaker(s). The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece readiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speakers radiates from the sound holes on the bottom of the lower block. The hole of the microphone is located between the upper and the lower block, on the right side..

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

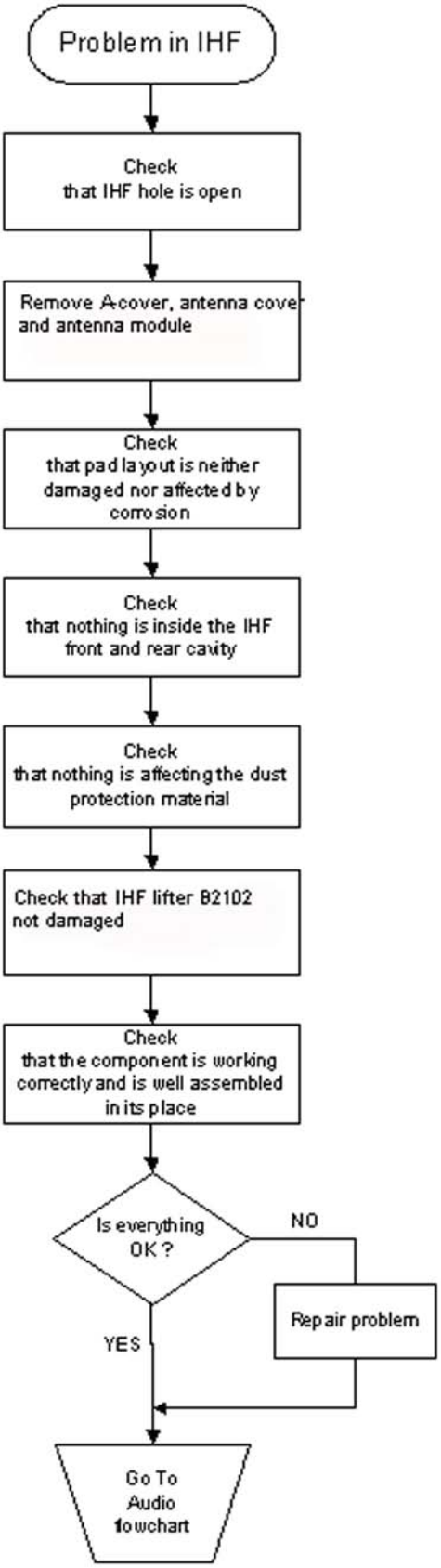
Earpiece troubleshooting

Troubleshooting flow



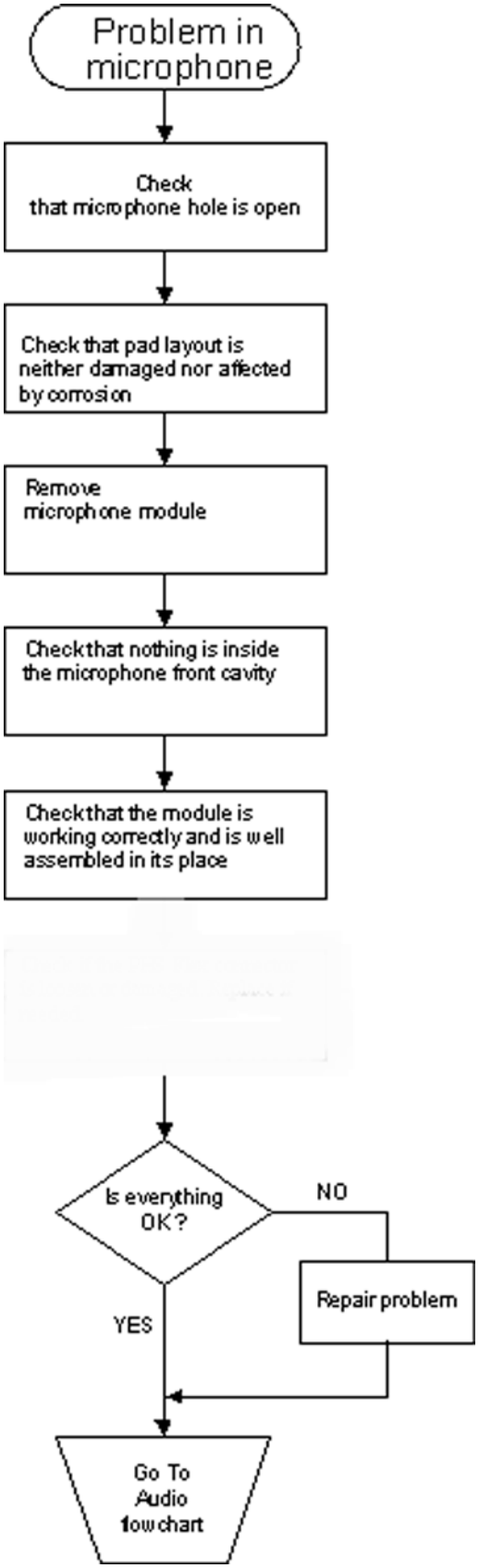
Acoustics IHF troubleshooting

Troubleshooting flow



Microphone troubleshooting

Troubleshooting flow



Baseband manual tuning guide

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File→ Scan Product.**
4. Choose **Tuning→Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 11 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
IBAT (ICal) Gain	5750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

7 — RF Troubleshooting and Manual Tuning Guide

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Table of Contents

List of Tables

List of Figures

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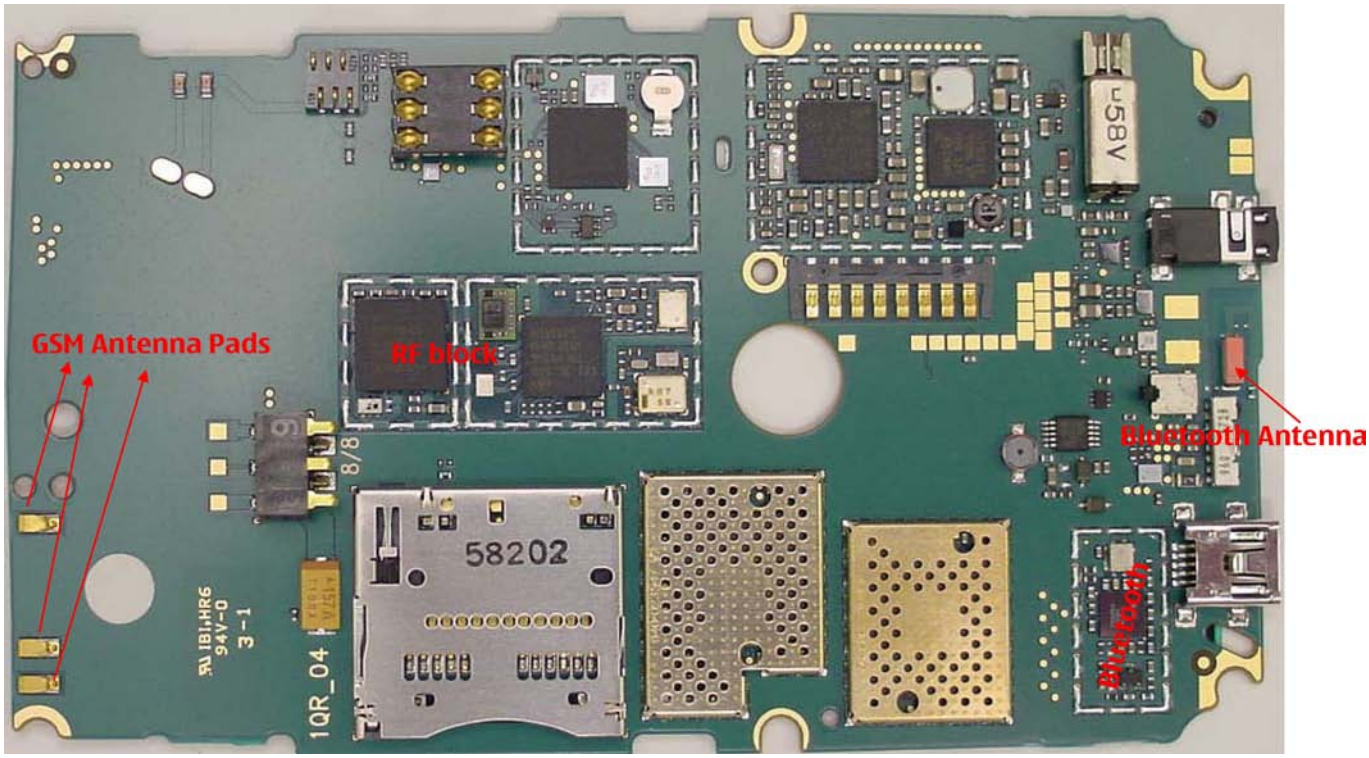
Introduction to RF troubleshooting

All measurements should be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

The RF section of the phone is around RF ASIC N7505, TX FEM N7520, and all of this RF section is built inside of non-removable shields A7506, A7507. Therefore, the engine will be replaced after carefully checked power and receiver tuning at antenna port.

RF key component placement



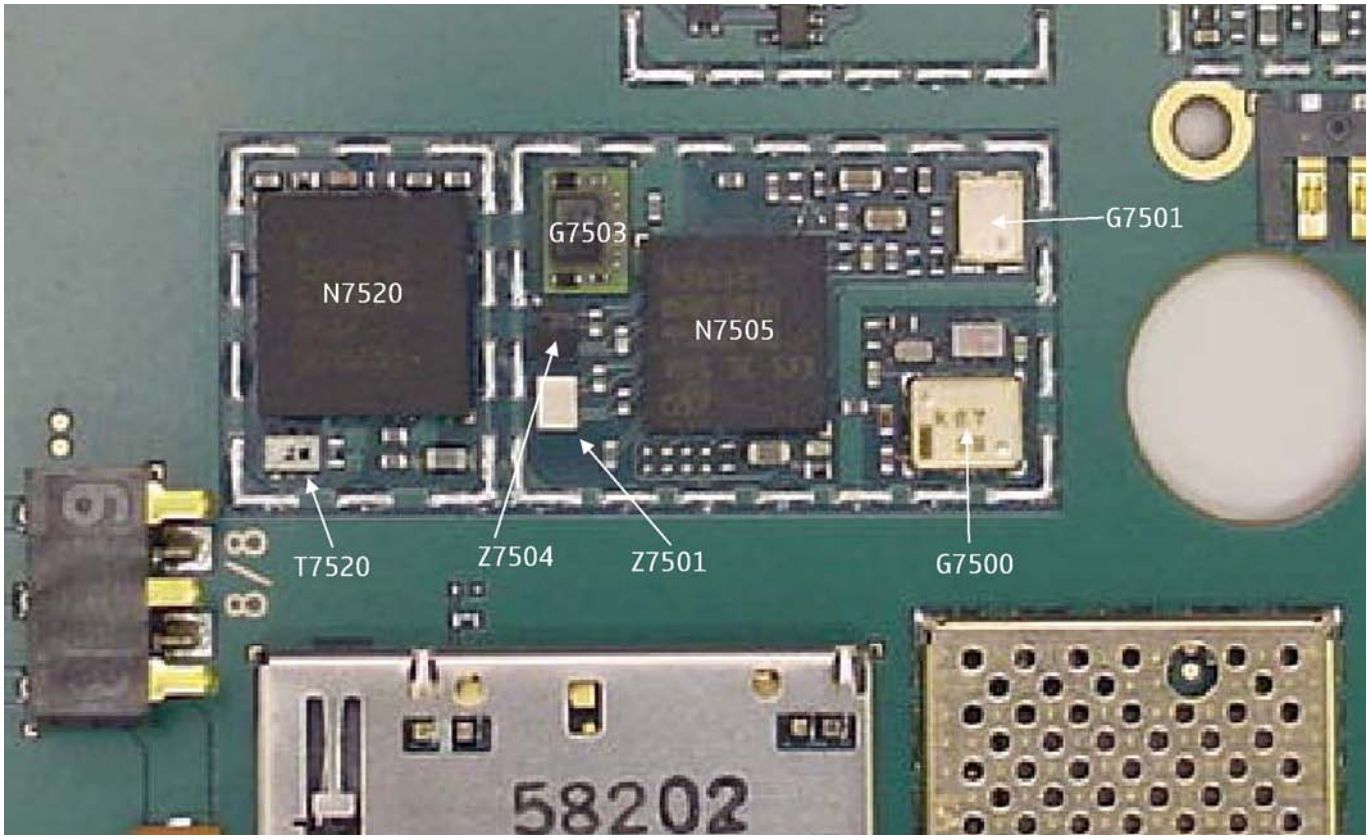


Figure 42 RM-88 RF components

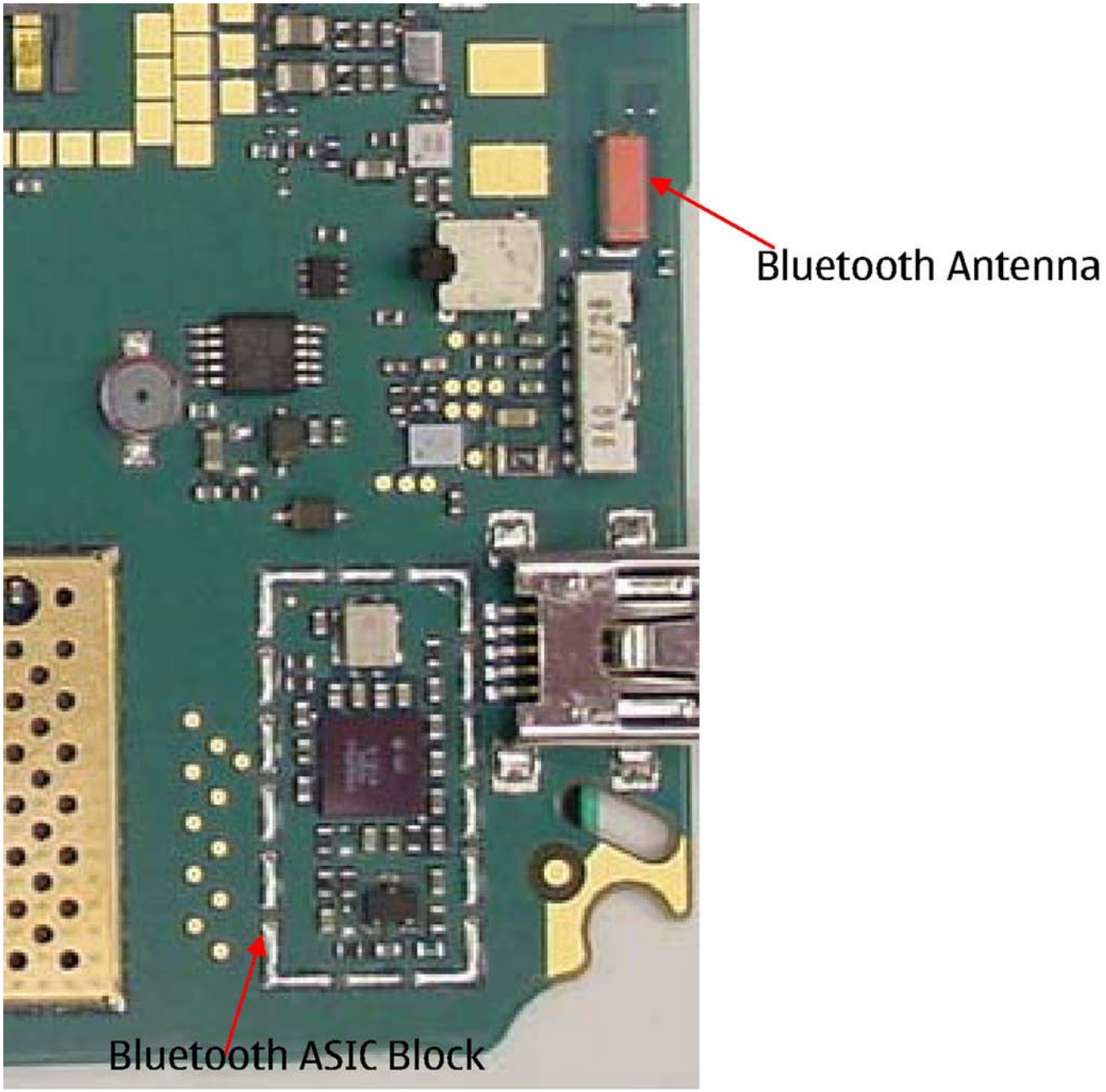


Figure 43 RM-88 BT component placement

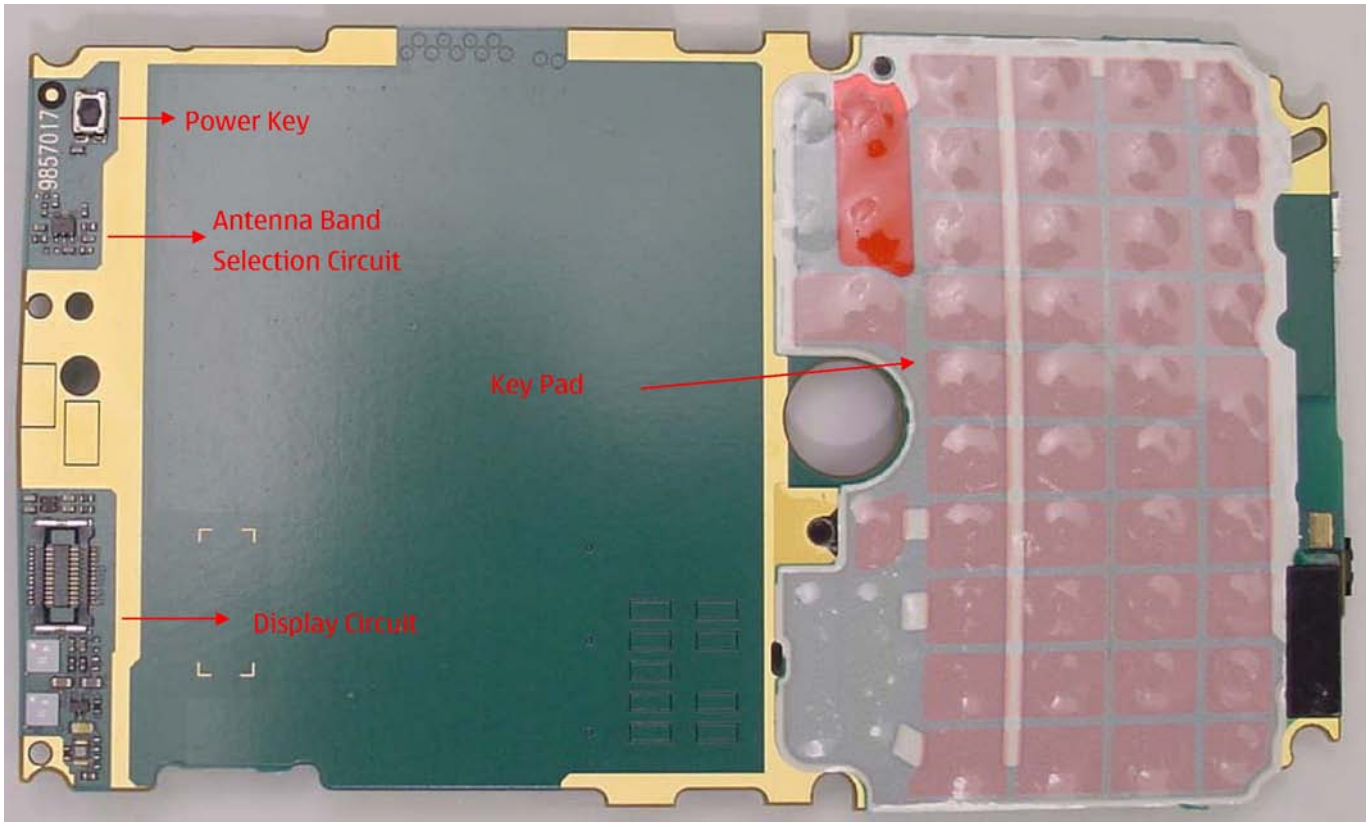


Figure 44 RM-88 component placement (top)

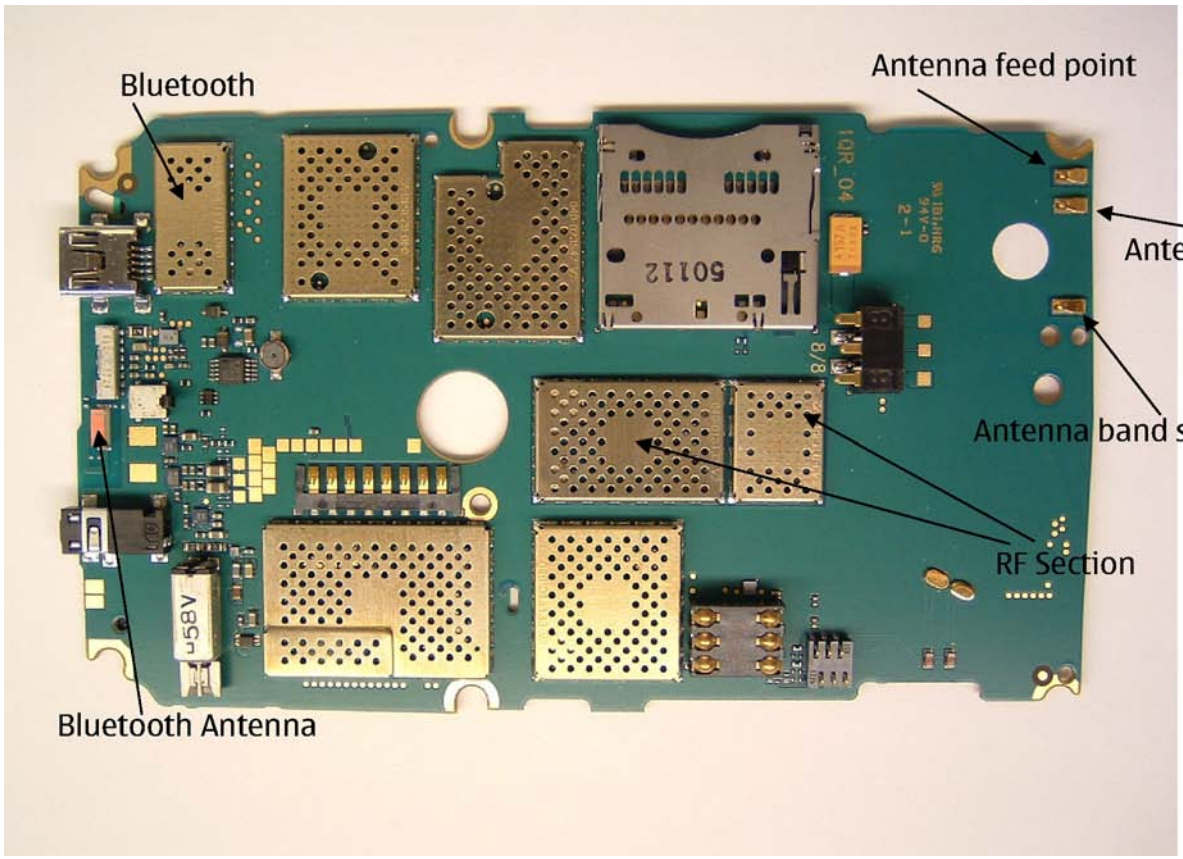


Figure 45 RM-88 component placement (bottom)

Receiver troubleshooting

Introduction to Rx troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal.

In GSM, the input signal can be either a real GSM signal or a CW (Continuous Wave) signal, which is 67.771 kHz above the carrier frequency.

For service tool usage instructions, refer to section **Service Tools and Service Concepts**.

General instructions for RX troubleshooting

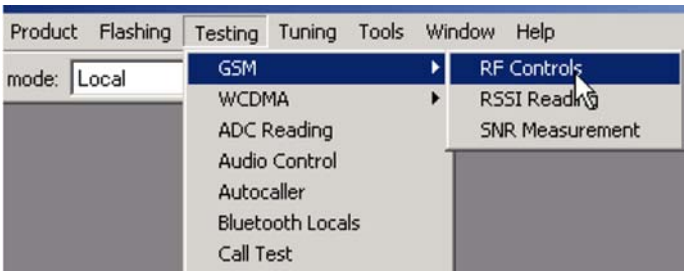
Steps

1. Connect a test jig to a computer with a DKE-2 cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect a DC power supply to a module test jig (MJ-67).

   Note: Set the DC supply voltage to 12 V and set the jumper connector on the test jig's **reg.pass** switch to “ON” position.
3. Connect an RF cable between the RF connector of the module test jig (MJ-67) and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM may be damaged.

   Note: Make sure that all connections are made to the correct RF connector.
4. Set Rx on.
   i Set the phone module to the test jig and start *Phoenix service software*.
   ii Initialize connection to the phone. (With FPS-10 use FBUS driver when using DKE-2 and COMBOX driver).
   iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone, scan product).
   iv From the toolbar, set operating mode to “Local”.
5. EGSM900, GSM850/1800/1900 troubleshooting
   i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .



   ii In the *RF Controls* window:
   - Select band "GSM850", “GSM900” or “GSM1800” or “GSM1900” (Default = “GSM850”).
   - Set Active unit to “Rx” (Default = “Rx”).
   - Set Operation mode to “Burst” (Default = “Burst”).

- Set Rx/Tx channel to 190 on GSM850, 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).
- Set Edge to "Off" (Default). (Not active in RXmode).
- Set Tx PA mode to "Free" (Default). (Not active in RXmode).
- Apply 942.46771 MHz (channel 37 + 67.710 kHz offset), 881.66771MHz (channel 190 + 67.710 kHz), 1842.86771 MHz (channel 700 + 67.710 kHz offset) or 1960.06771 MHz (channel 661 + 67.71 kHz) –90 dBm signal to the RF-connector (remember to compensate for cable attenuation).

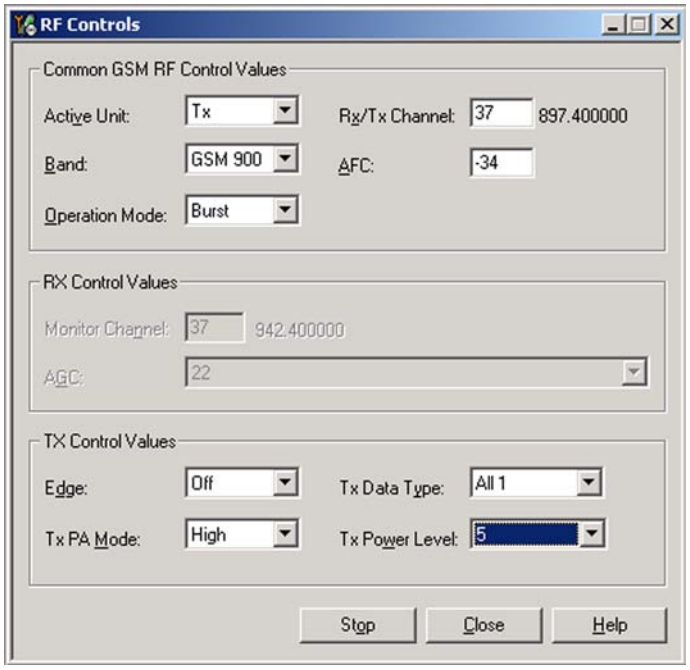


Figure 46 RF Controls window

GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→GSM→RSSI Reading** .
3. Set the RF signal generator for channel frequency +67.771 kHz CW mode with –80 dBm signal.

   Alternatively set the cellular tester downlink channel to the appropriate channel. Make sure that the tester is set to continuous mode, not to burst mode.

4. In the *RSSI Reading* window, select the appropriate band and channel.

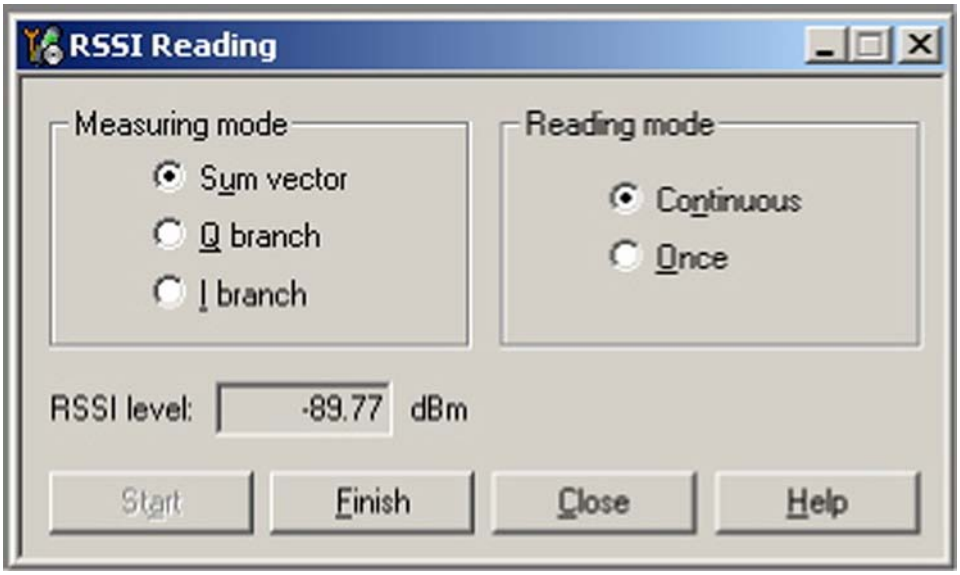


Figure 47 ***RSSI Reading*** **window**

5. To start the measurement, activate GSM Rx chain, click **Start**.

Results

RSSI reading values of the selected band and channel are displayed. The RSSI level must be the same value which is set at the signal generator (-90 dBm).

If RSSI reading is far away from -90dBm, try to do RX tuning. Change engine if problem still shows up after re-tuning.

Transmitter troubleshooting

General instructions for TX troubleshooting

Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls".
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software.

> **Caution:** Never activate the GSM transmitter without a proper antenna load. There should be always 50 ohm load connected to the RF connector (antenna, RF-measurement equipment or at least 2 watts dummy load), otherwise GSM PA may be damaged.

Steps

1. Connect a test jig to a computer with a DKE-2 cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.

2. Connect a DC power supply to a module jig (MJ-67).

   Note: When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.

   Set the DC supply voltage to 12V and set the jumper connector on the test jig's **reg.pass** switch to "ON" position.

3. Connect an RF cable between the RF connector of the module test jig (MJ-69) and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM may be damaged.

   Note: There are two antenna connectors in the module jig:

   - one for GSM
   - one for Bluetooth

   Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

   Note: The maximum input power of a spectrum analyser is +30 dBm.

   To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.

4. Set Tx on.

   i Set the phone module to the test jig and start *Phoenix service software*.

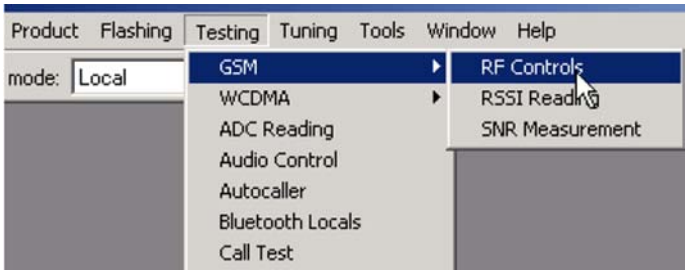
   ii Initialize connection to the phone. (With FPS-10 use FBUS driver when using DAU-9S and COMBOX driver).

   iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone).

   iv From the toolbar, set operating mode to "Local".

5. EGSM900, GSM850/1800/1900 troubleshooting

   i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .



   ii In the *RF Controls* window:

   - Select band "GSM850", "GSM900" or "GSM1800" or "GSM1900" (Default = "GSM850").
   - Set Active unit to "Tx" (Default = "Rx").
   - Set Operation mode to "Burst" (Default = "Burst").
   - Set Tx data type to "Random" (Default = "All1").
   - Set Rx/Tx channel to 190 on GSM850, 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).
   - Set Edge to "Off" (Default).
   - Set Tx PA mode to "Free" (Default).
   - Set power level to 5 (Default = 19) on GSM850/900 or to 0 (Default = 15) on GSM1800 or GSM1900.

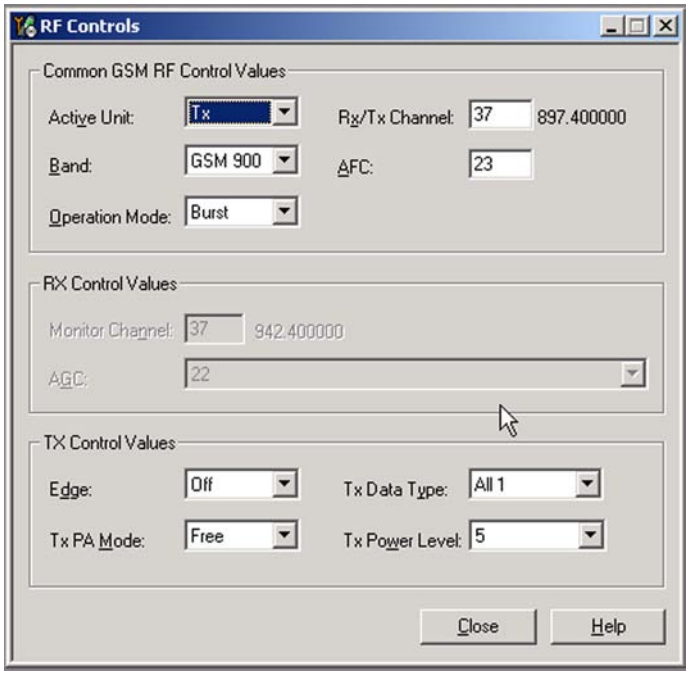
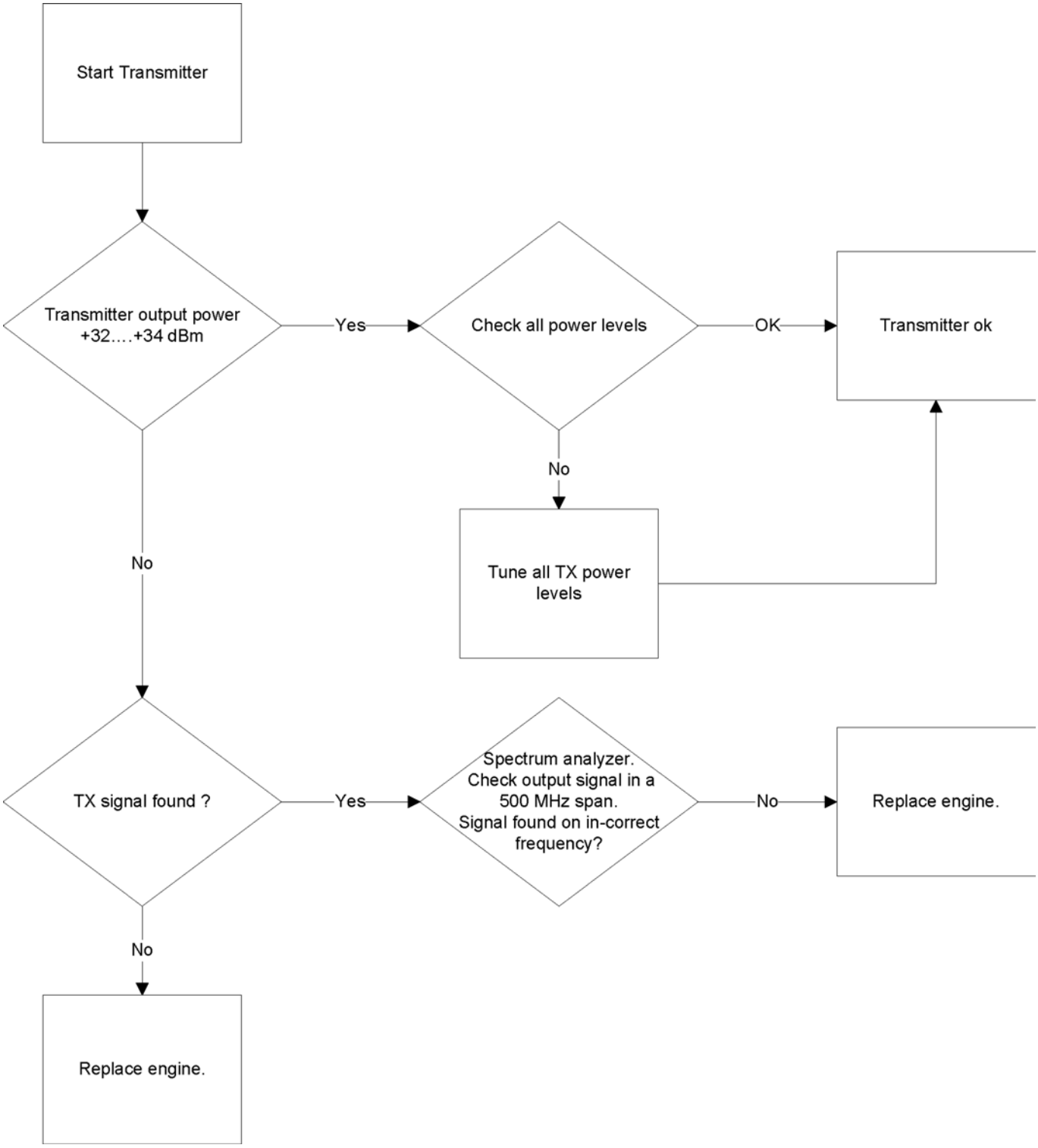


Figure 48 RF Controls window

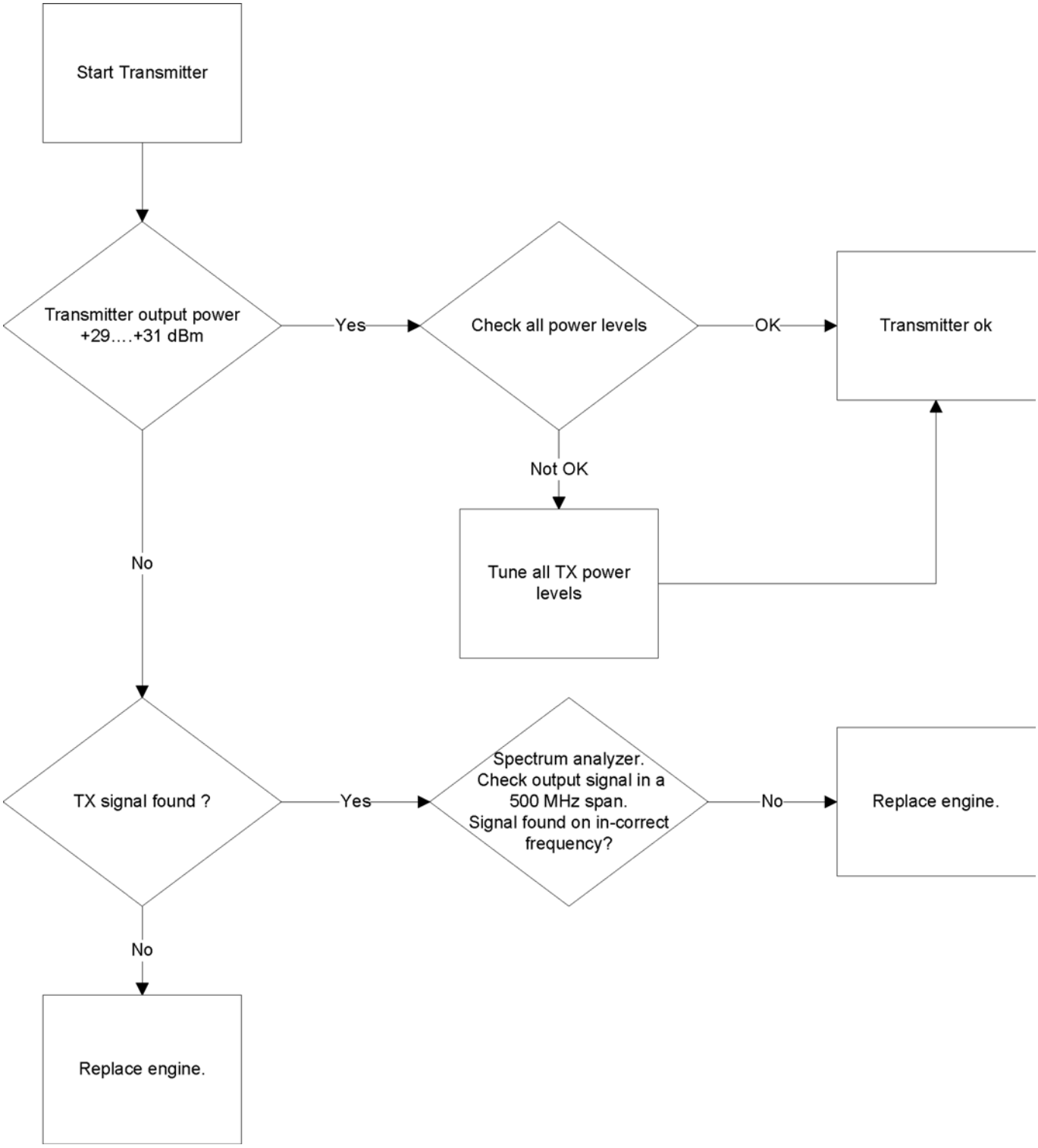
TX 850/900 troubleshooting

Troubleshooting flow



TX 1800/1900 troubleshooting

Troubleshooting flow



Checking antenna functionality

The main antenna has one antenna: GSM .

In the GSM antenna, there is one Feed and two GND contacts.

The contacts of the GSM antenna are separated in the (RDC = 0 ohm) short-circuit.

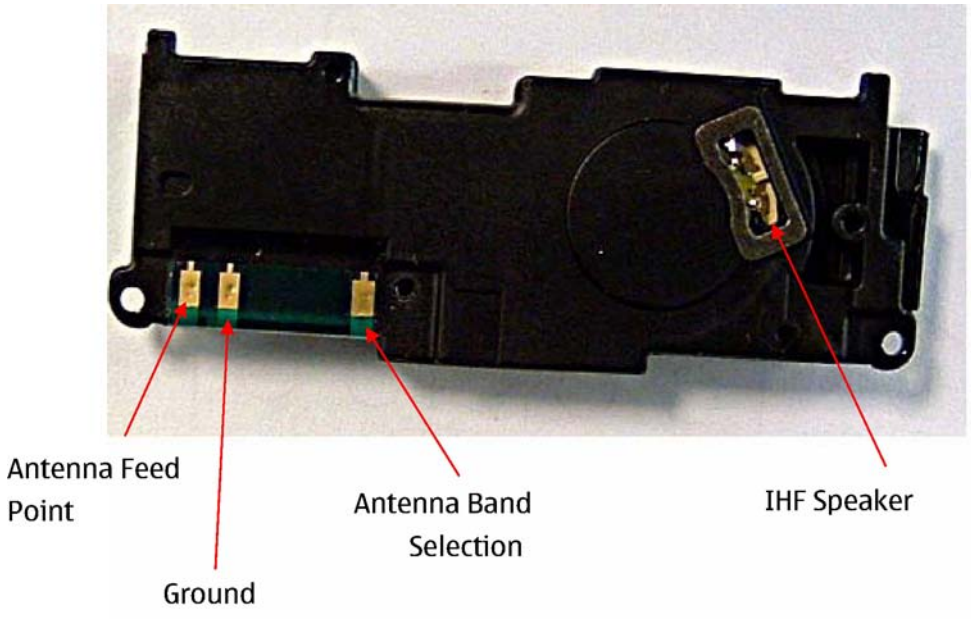


Figure 49 Main antenna

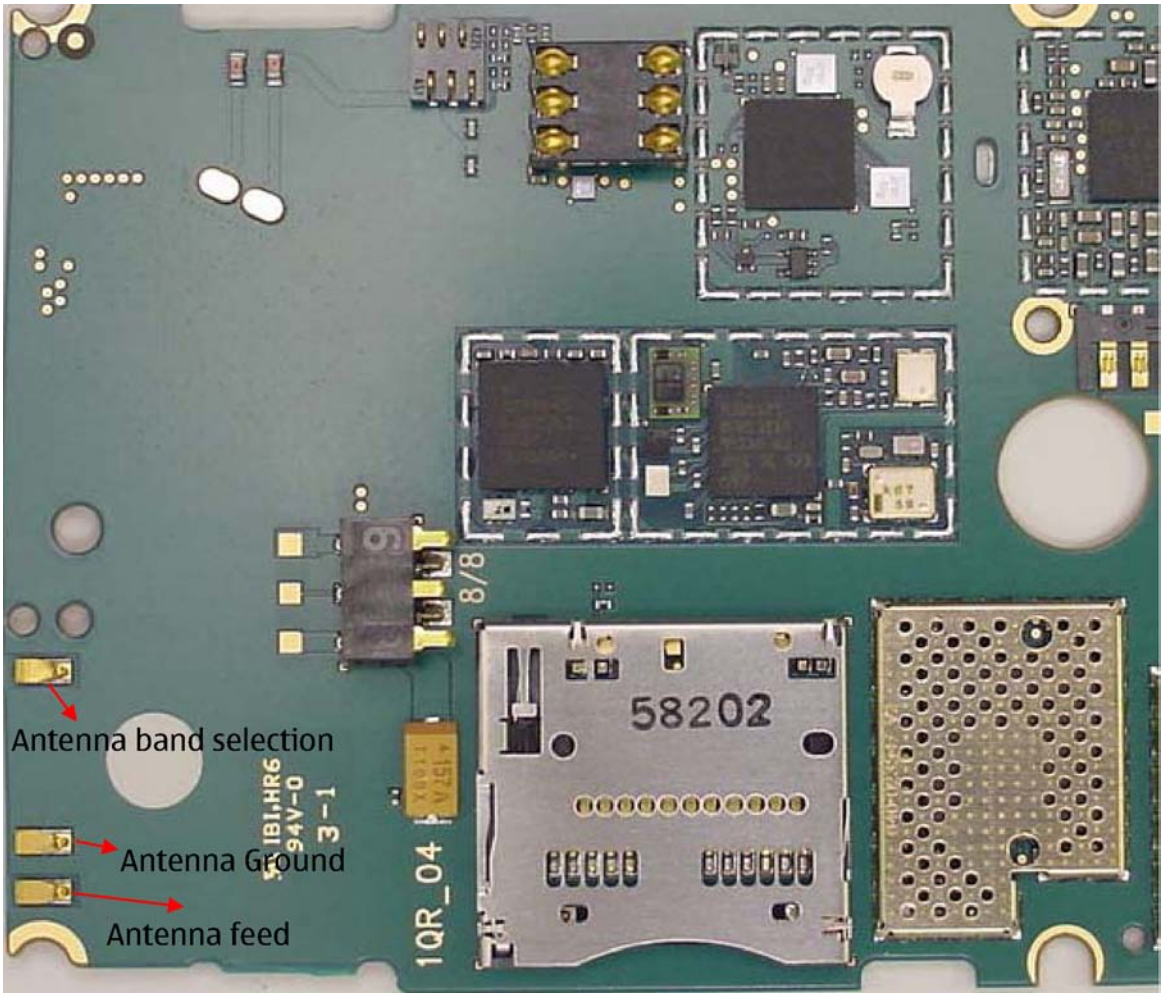


Figure 50 Feed and GND spots of the main antenna

The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

BT antenna

BT antenna has one Feed and one GND contact. The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

RF tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components is changed
- flash Memory chip is changed or otherwise corrupted.

RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF side.

Important: After RF component changes, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken in account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. In the following table there are RF attenuations of the module jig:

Band	Attenuation
GSM850	0.2 dB
GSM900	0.2 dB
GSM1800	0.3 dB
GSM1900	0.6 dB

RF autotuning

Prerequisites

For information on the recommended test set-up, refer to the corresponding information on PWS/NOL.

Before you can use the auto-tune feature, the GPIB driver from the GPIB card vendor must be installed and running.

The autotune **.ini** file must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x* \autotune_xx-x*.ini** (**= indicates the type designator of the phone, e.g. RM-1*)

Context

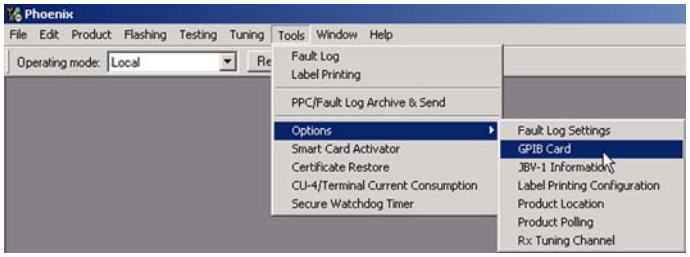
RF autotuning is performed with the aid of Digital Radio Communication Tester. Autotuning covers all RF tunings that are needed to perform after RF component repairs.

Note: Do not perform RF autotuning without a proper reason. Phones are tuned in production and an RF tuning may be performed only after component repairs or if the RF tuning information is lost.

Steps

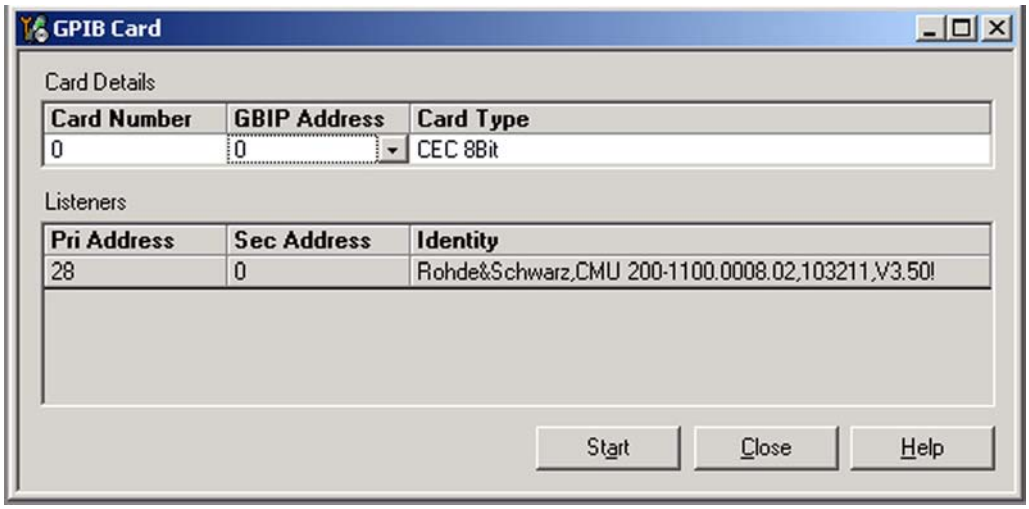
1. Connect the communication tester to the GPIB bus.

2. Start Phoenix service software.
3. From the Tools menu, choose Options -> GPIB Card.

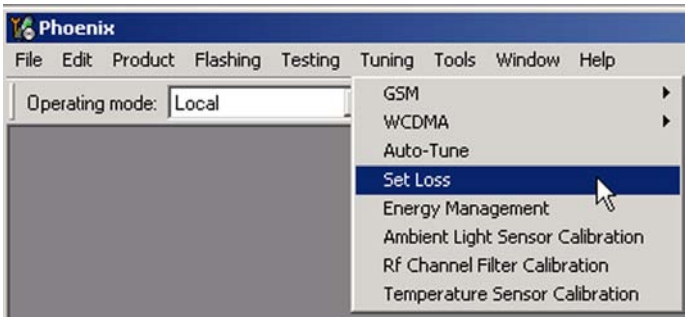


4. In the Card Type line, select CEC8Bit, then click Start.

   After clicking Start, the name of the communication tester appears in the list of found Listeners.

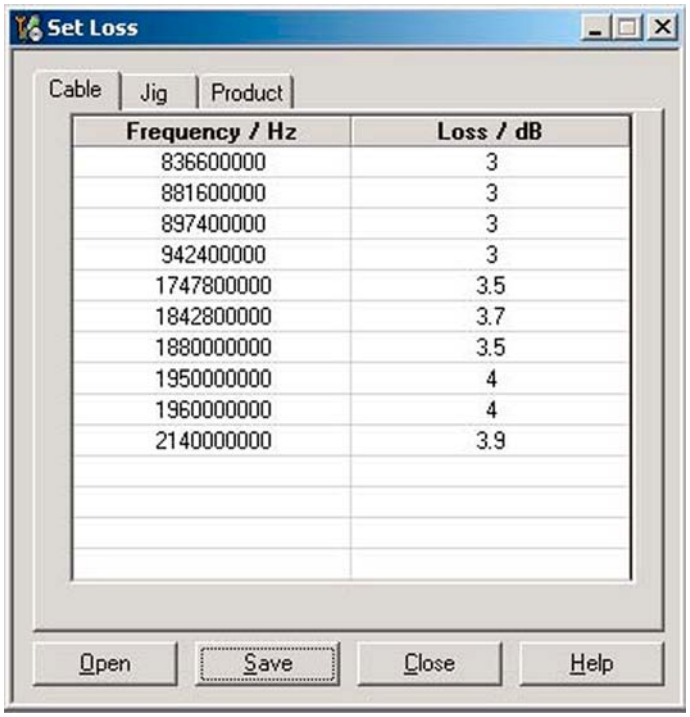


5. To specify the cable loss from module jig to the communication tester, choose "Set Loss" from the Tuning menu.

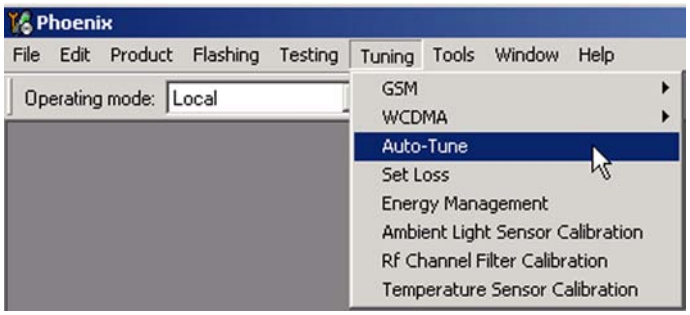


6. Click the Cable tab and add the extra cable attenuation.

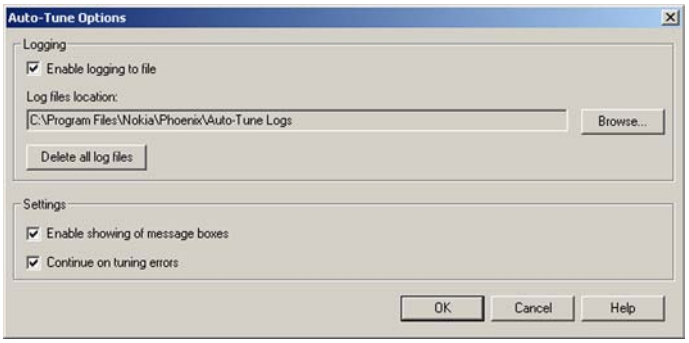
   Note: Cable losses have to be determined on the basis of a cable used.



7. To start autotuning, choose Auto-Tune from the Tuning menu.



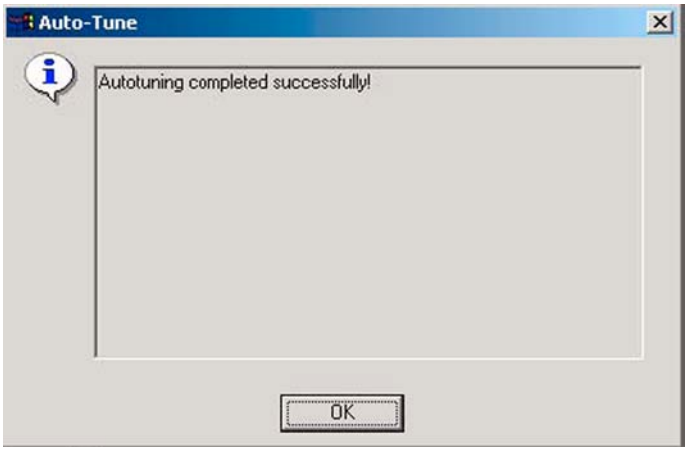
8. In the Auto-Tune window, click Options.
9. In the Auto-Tune options window, see that the "Enable showing of messages" check box is checked, then click OK.



10. To complete the RF autotuning, click OK.

Results

"Autotuning completed successfully" message appears.



System mode independent manual tunings

Rf channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of Rx and Tx ASICs that limit the bandwidth of BB IQ signals.

One common calibration is made for GSM.

Table 12 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results

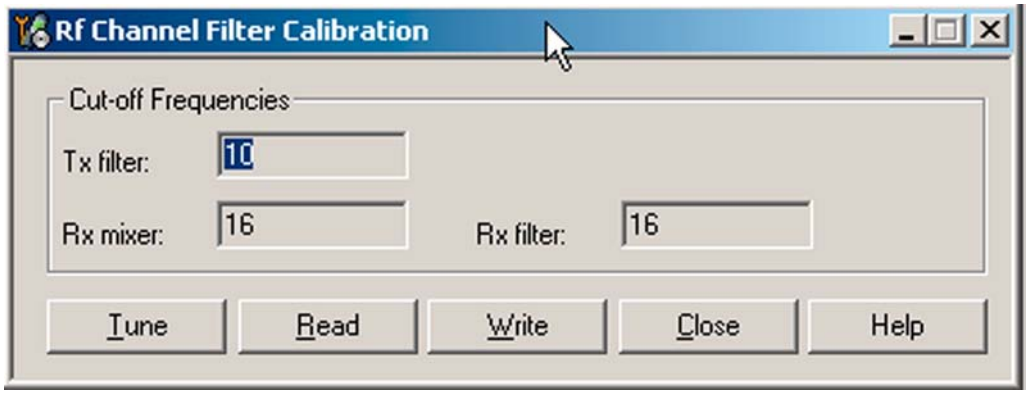


Figure 51 Rf channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

GSM receiver tunings

Rx calibration (GSM)

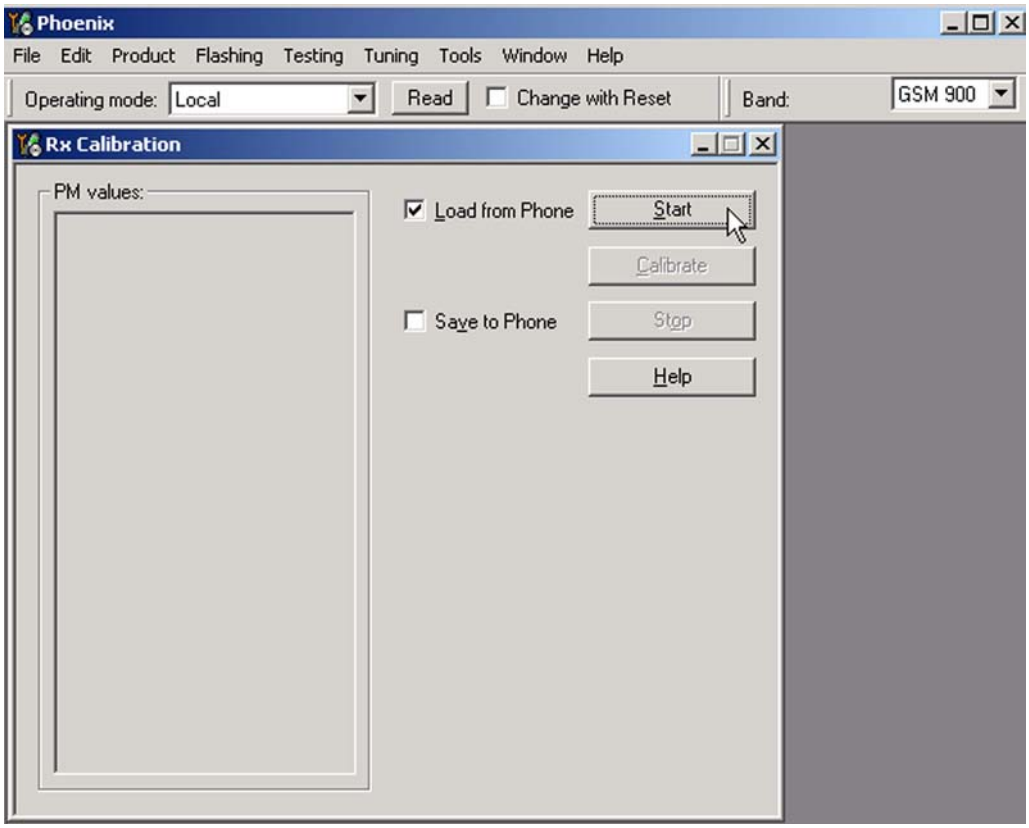
Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

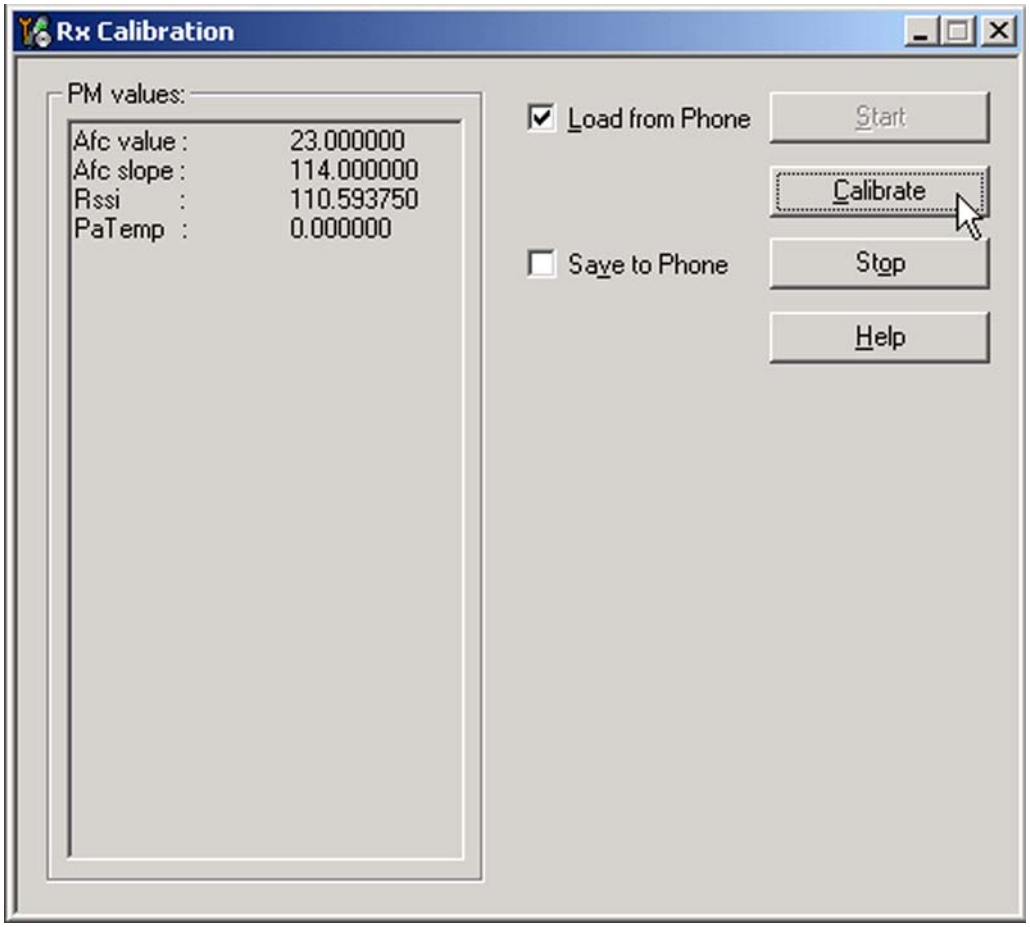
Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Rx Calibration** .
5. Check the **Load from Phone** check box, and uncheck **Save to Phone**.
6. From the **Band** drop-down menu, choose e.g. **GSM900**.

7. Click **Start**.

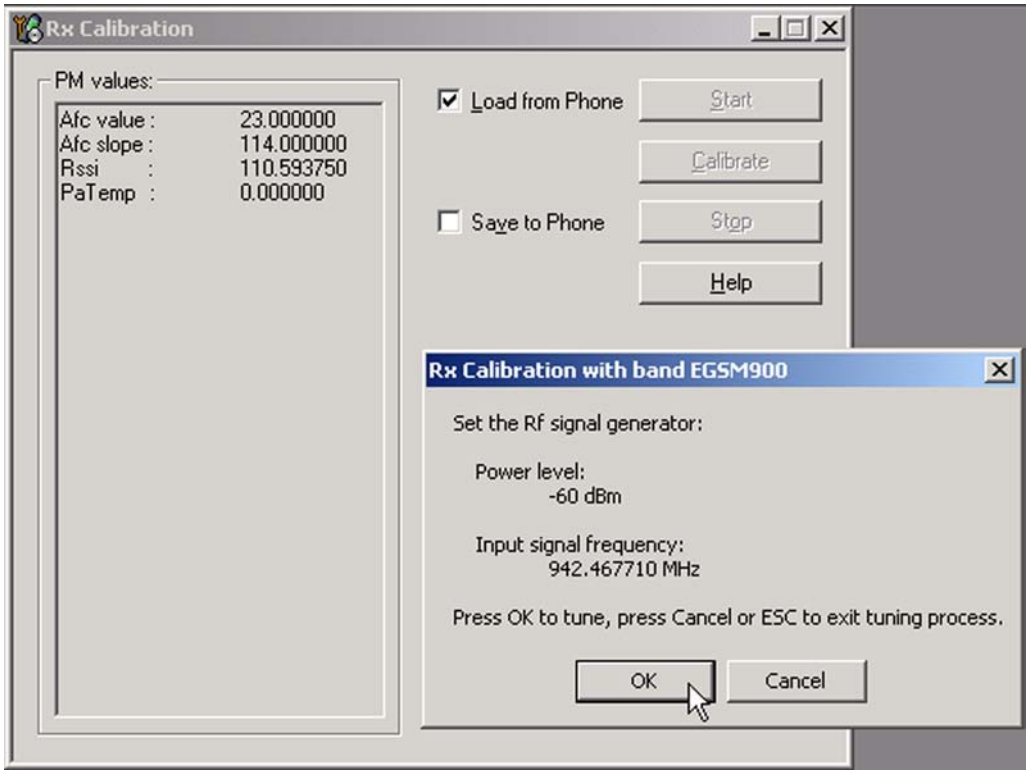


8. Click **Calibrate**.



9. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** pop-up window.

   Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.

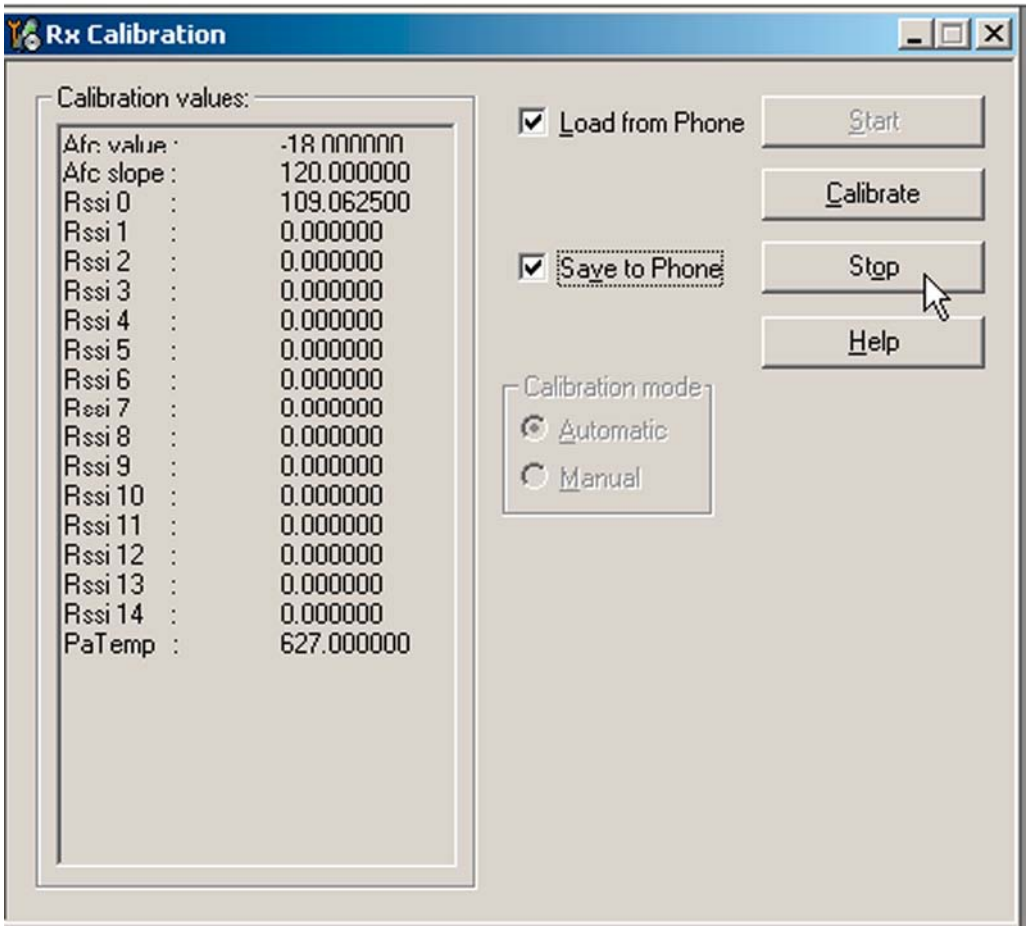


10. To perform the tuning, click **OK**.
11. Check that the tuning values are within the limits specified in the following table:

Table 13 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value	-200	-105...62	200	
AFC slope	0	122	200	
RSSI0	106	107...110	114	dB
GSM900				
AFC Value	-200	-105...62	200	
AFC slope	0	122	200	
RSSI0	106	107...110	114	dB
GSM1800				
RSSI0	104	104...109	114	dB
GSM1900				
RSSI0	104	104...109	114	dB

12. To save values to the phone, check the **Save to Phone** check box, and click **Stop**.



Next actions

Repeat steps 3 to 8 for GSM850, GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be done before the Rx Band Filter Response Compensation

Context

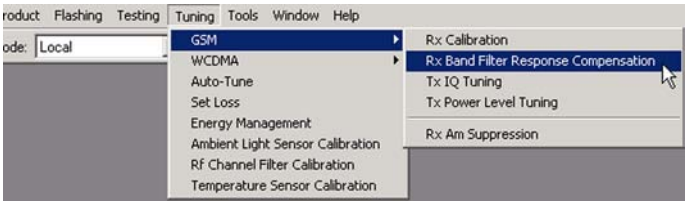
In each GSM Rx band, there's a band rejecting filter in front of RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

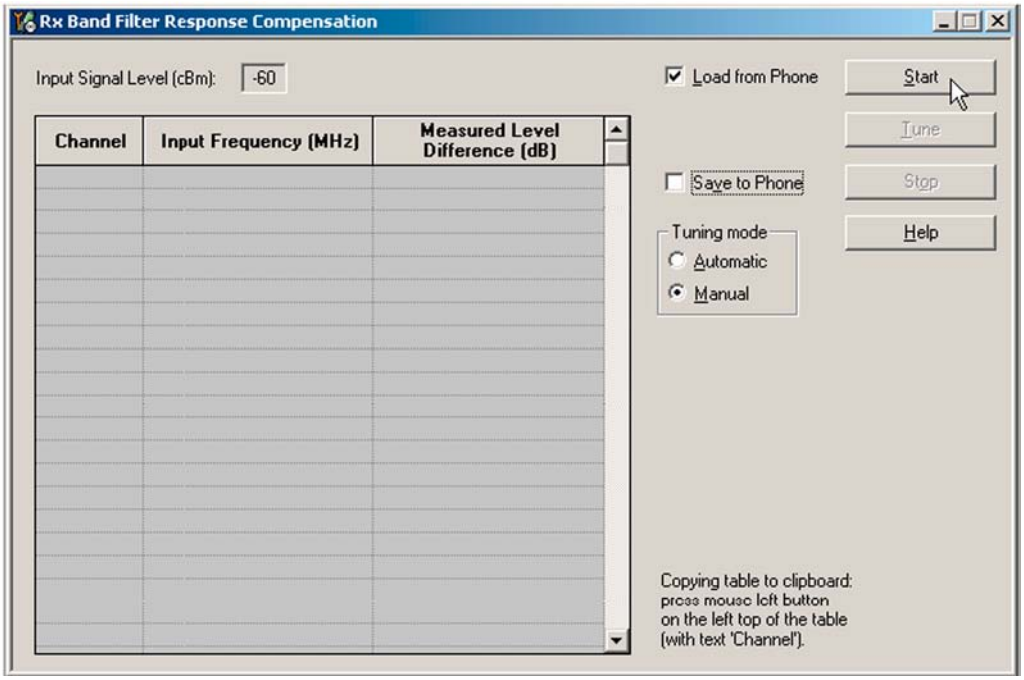
Steps

1. Connect module jig's GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.

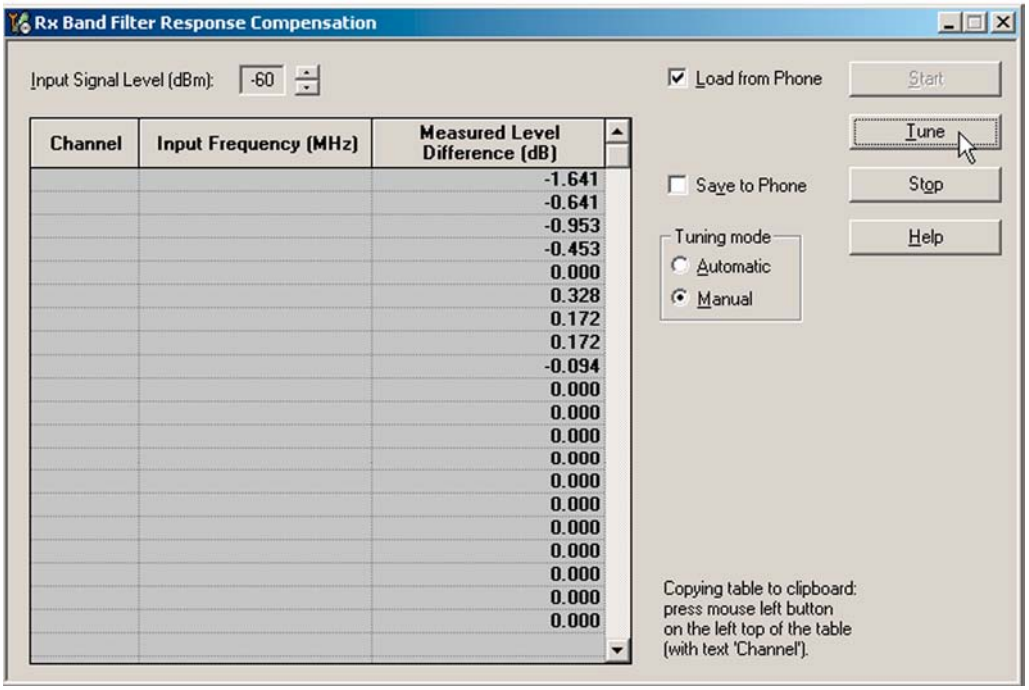
3. From the Tuning menu, choose GSM -> Rx Band Filter Response Compensation.



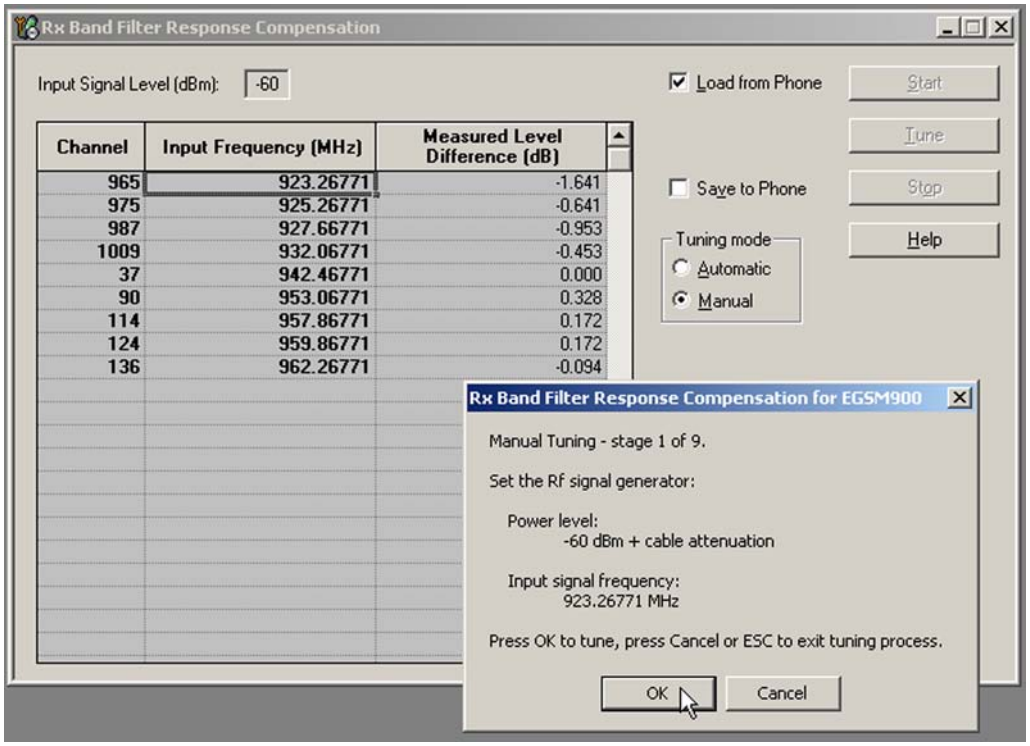
4. Check “Manual” and “Load from Phone” check boxes. Clear “Save to Phone” check box
5. Click Start.



6. Click Tune.



7. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Band Filter Response Compensation for EGSM900" popup window.



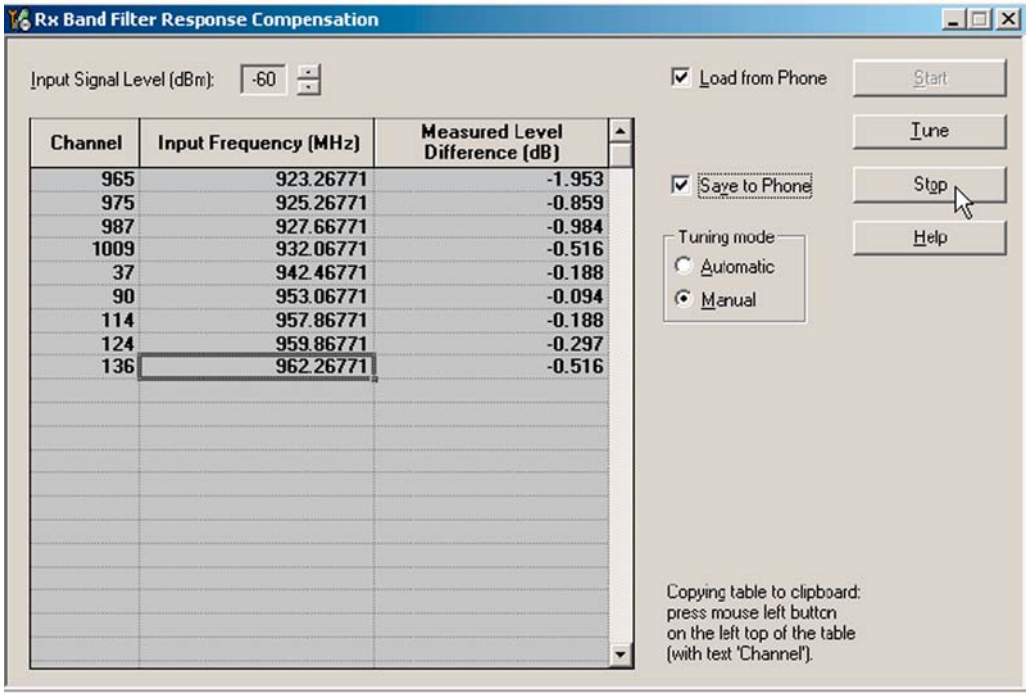
8. To perform tuning, click OK.
9. Go through all 9 frequencies.

10. Check that the tuning values are within the limits specified in this table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118 / 867.26771 MHz	-10	-1	5	dB
Ch. 128 / 869.26771 MHz	-3	0	5	dB
Ch. 140 / 871.66771 MHz	-3	0	5	dB
Ch. 172 / 878.06771 MHz	-3	0	5	dB
Ch. 190 / 881.66771 MHz	-3	0	5	dB
Ch. 217 / 887.06771 MHz	-3	0	5	dB
Ch. 241 / 891.86771 MHz	-3	0	5	dB
Ch. 251 / 893.86771 MHz	-3	0	5	dB
Ch. 261/ 895.86771 MHz	-10	-1	5	dB
GSM900				
Ch. 965 / 923.26771 MHz	-10	-1	5	dB
Ch. 975 / 925.26771 MHz	-3	0	5	dB
Ch. 987 / 927.66771 MHz	-3	0	5	dB
Ch. 1009 / 932.06771 MHz	-3	0	5	dB
Ch. 37 / 942.46771 MHz	-3	0	5	dB
Ch. 90 / 953.06771 MHz	-3	0	5	dB
Ch. 114 / 957.86771 MHz	-3	0	5	dB
Ch. 124 / 959.86771 MHz	-3	0	5	dB
Ch. 136 / 962.26771 MHz	-10	-1	5	dB
GSM1800				

	Min	Typ	Max	Unit
Ch. 497 / 1802.26771 MHz	-10	-1	5	dB
Ch. 512 / 1805.26771 MHz	-3	0	5	dB
Ch. 535 / 1809.86771 MHz	-3	0	5	dB
Ch. 606 / 1824.06771 MHz	-3	0	5	dB
Ch. 700 / 1842.86771 MHz	-3	0	5	dB
Ch. 791 / 1861.06771 MHz	-3	0	5	dB
Ch. 870 / 1876.86771 MHz	-3	0	5	dB
Ch. 885 / 1879.86771 MHz	-3	0	5	dB
Ch. 908 / 1884.46771 MHz	-10	-1	5	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-10	-1	5	dB
Ch. 512 / 1930.26771 MHz	-3	0	5	dB
Ch. 537 / 1935.26771 MHz	-3	0	5	dB
Ch. 586 / 1945.06771 MHz	-3	0	5	dB
Ch. 661 / 1960.06771 MHz	-3	0	5	dB
Ch. 736 / 1975.06771 MHz	-3	0	5	dB
Ch. 794 / 1986.66771 MHz	-3	0	5	dB
Ch. 810 / 1989.86771 MHz	-3	0	5	dB
Ch. 835 / 1994.86771 MHz	-10	-1	5	dB

11. Check the "Save to Phone" check box and click Stop if the values are within the limits.



Next actions

Repeat the steps 4 to 10 for GSM850, GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

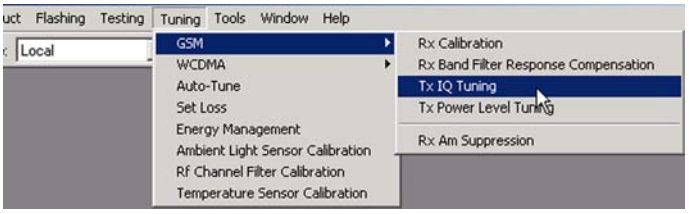
Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning tuning balances the I and Q branches.

Tx IQ tuning must be performed on all GSM bands. .

Steps

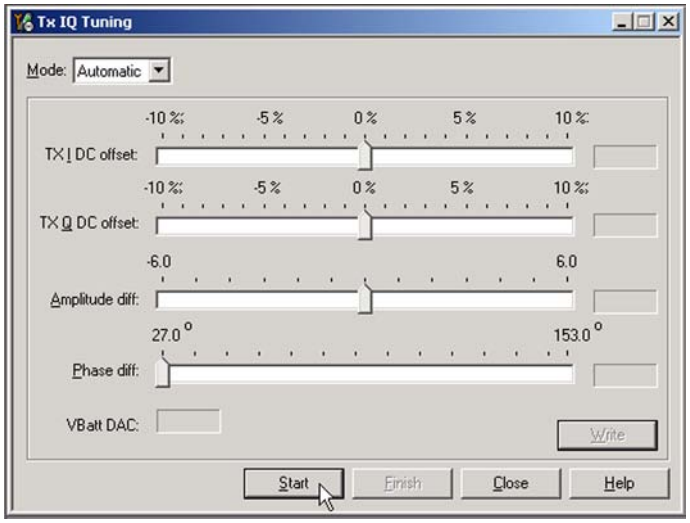
1. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
2. From the Tuning menu, choose GSM -> Tx IQ Tuning.



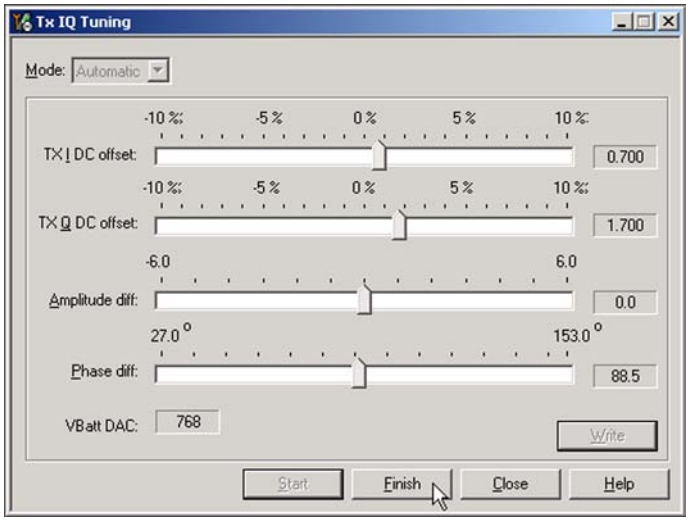
3. Set Mode to Automatic and Edge to Off.
4. Click Start.

   Wait until automatic tuning has finished and moved the sliders.

   Values are written to the phone memory automatically.



5. When the values have been written to the phone memory, click the Finish button to end the tuning.



6. Change band to GSM850 and repeat steps 4 to 5.
7. Change band to GSM1800 and repeat steps 4 to 5.
8. Change band to GSM1900 and repeat steps 4 to 5.
9. To close the tuning window, click Close.

Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the table below. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	○
GSM900				

	Min	Typ	Max	Unit
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	○
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	○

Tx power level tuning (GSM)

Context

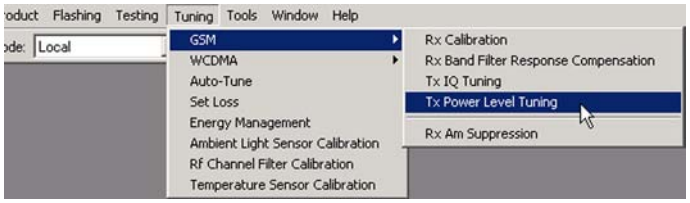
Because of variations at IC process and discrete component values, actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

For EDGE transmission the bias settings of the FEM are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
3. From the Tuning menu, choose GSM -> Tx Power Level Tuning.



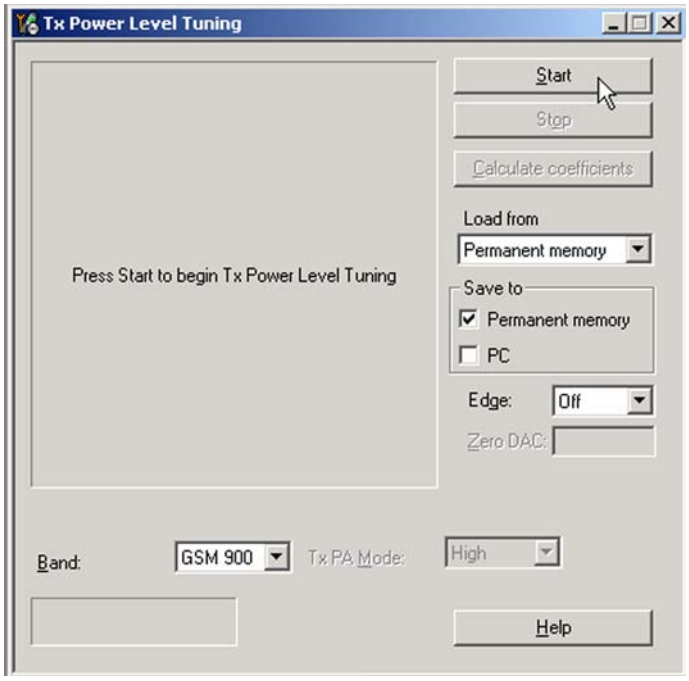
4. Set Mode to Automatic and Edge to Off.
5. Set the spectrum analyzer for power level tuning:

Frequency	channel frequency (836.6MHz GSM850, 897.4MHz GSM900, 1747.8MHz GSM1800, 1880MHz GSM1900)
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz

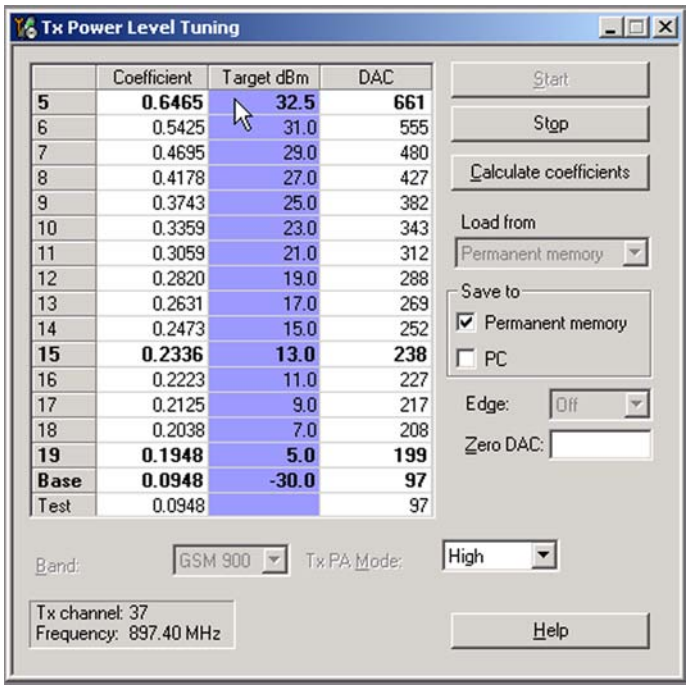
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations in the account!

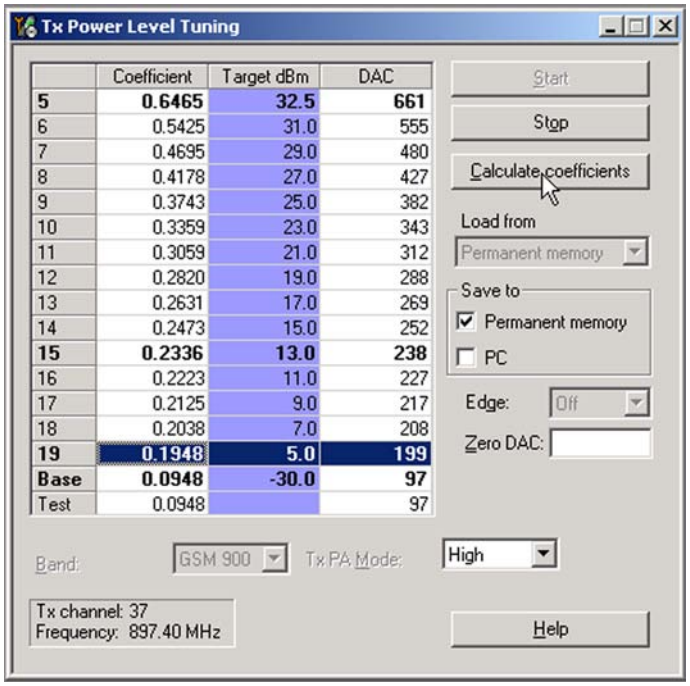
6. Click Start.



7. Adjust power levels 5, 15 and 19 to correspond the "Target dBm" column by pressing + or – keys.



8. Click Calculate Coefficients.

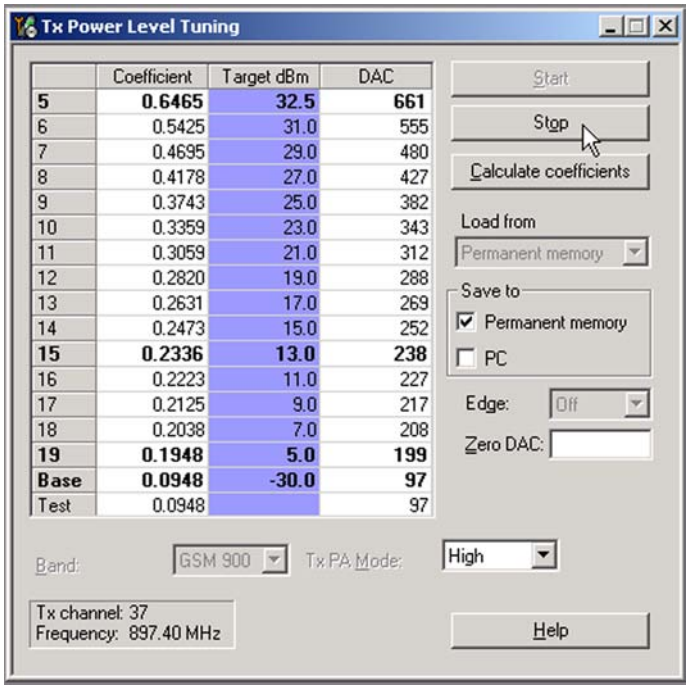


9. Check that the coeffiecient values are within the limits specified in the following table.

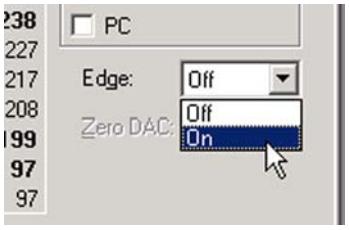
	Min	Typ	Max
GSM850 EDGE off			
PL5 coefficient	0.45	0.626	0.73
PL15 coefficient		0.234	
PL19 coefficient	0.12	0.195	0.3
GSM850 EDGE on			
PL8 coefficient	0.35	0.419	0.6
PL15 coefficient		0.247	
PL19 coefficient	0.12	0.204	0.3
GSM900 EDGE off			
PL5 coefficient	0.45	0.626	0.73
PL15 coefficient		0.234	
PL19 coefficient	0.12	0.195	0.3
GSM900 EDGE on			
PL8 coefficient	0.35	0.419	0.6
PL15 coefficient		0.247	
PL19 coefficient	0.12	0.204	0.3
GSM1800 EDGE off			
PL0 coefficient	0.45	0.51	0.7

	Min	Typ	Max
PL11 coefficient		0.219	
PL15 coefficient	0.12	0.185	0.3
GSM1800 EDGE on			
PL2 coefficient	0.35	0.394	0.6
PL11 coefficient		0.23	
PL15 coefficient	0.12	0.194	0.3
GSM1900 EDGE off			
PL0 coefficient	0.45	0.482	0.7
PL11 coefficient		0.218	
PL15 coefficient	0.12	0.184	0.3
GSM1900 EDGE on			
PL2 coefficient	0.35	0.377	0.6
PL11 coefficient		0.23	
PL15 coefficient	0.12	0.193	0.3

If the values are within the limits, check that the "Save to Phone Permanent Memory" check box is checked and click Stop.



10. Set **Edge** mode on and start tuning again. Change video averaging to 50.



11. Tune EDGE power levels to the corresponding target power levels.

    Only power levels **8**, **15** and **19** are tuned in GSM900 and **2**, **10** and **15** in GSM1800/1900. The rest are calculated by clicking the Calculate Coefficients button. Check the coefficients against the RF tuning limits table presented in Step 9.

12. When the tuning is completed, click Stop.

Next actions

Repeat steps 4 to 9 for GSM1800 and GSM1900. On those bands only power levels **0**, **11** and **15** need to be tuned.

8 — System Module

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Table of Contents

List of Tables

List of Figures

Baseband description

System module block diagram

The device is a quad-band GSM mono-block product with full QWERTY keyboard. It is based on Series 60 UI Style on the Symbian Operating System (SOS) release (version 9.1).

The device has two antennas; Internal antenna for cellular quad band GSM and BT antenna.

Bluetooth module has its own antenna. System calculations assume 15dB antenna isolation between Bluetooth and cellular GSM antenna.

Architecture overview

The device is a monoblock quadband GSM/EDGE 850/900/1800/1900 handportable phone running on Symbian series 60 release 3.0.

Product segment is a Smart phone.

The device baseband is single processor architecture based on CeMEnt G3.1S engine (CeBBo1GSM BB + Ritsa 4.5 RF).

The baseband includes following HW-blocks:

- RAP, GSM EDGE BaseBand ASIC (ARM926EJ-S MCU, Lead3 PH3 DSP)
- N2200 , primary Energy Management ASIC
- N2300, secondary Energy Management ASIC
- T-combo memory, 256Mbit NOR FLASH + 256Mbit DDR-SDRAM + 1Gbit Mux-one Nand combo memory
- Audio (Microphone, Speaker, IHF and external audio)
- EL keyboard backlightning
- Ambient light sensor
- Bottom Connectors (Mini USB-B + 2.5mm Headset Jack + Dynamo DC jack)
- SIM Interface
- BB-RF Interface
- Bluetooth BTPerf 2.3 (BT 2.0 + EDR)
- UI (Oxford QVGA LCD, QWERTY keyboard)
- IR Interface (IrDA, 115.2kbit/s)
- Mini SD Interface (hot swappable)

RF block includes:

- N7505 AHNE RF ASIC (Quad-band GSM functionality based on Ritsa 4.5 engine.)
- N7520 front end module (PA and antenna switch)
- G7500 VCO and G7501 VCXO (38.4MHz)

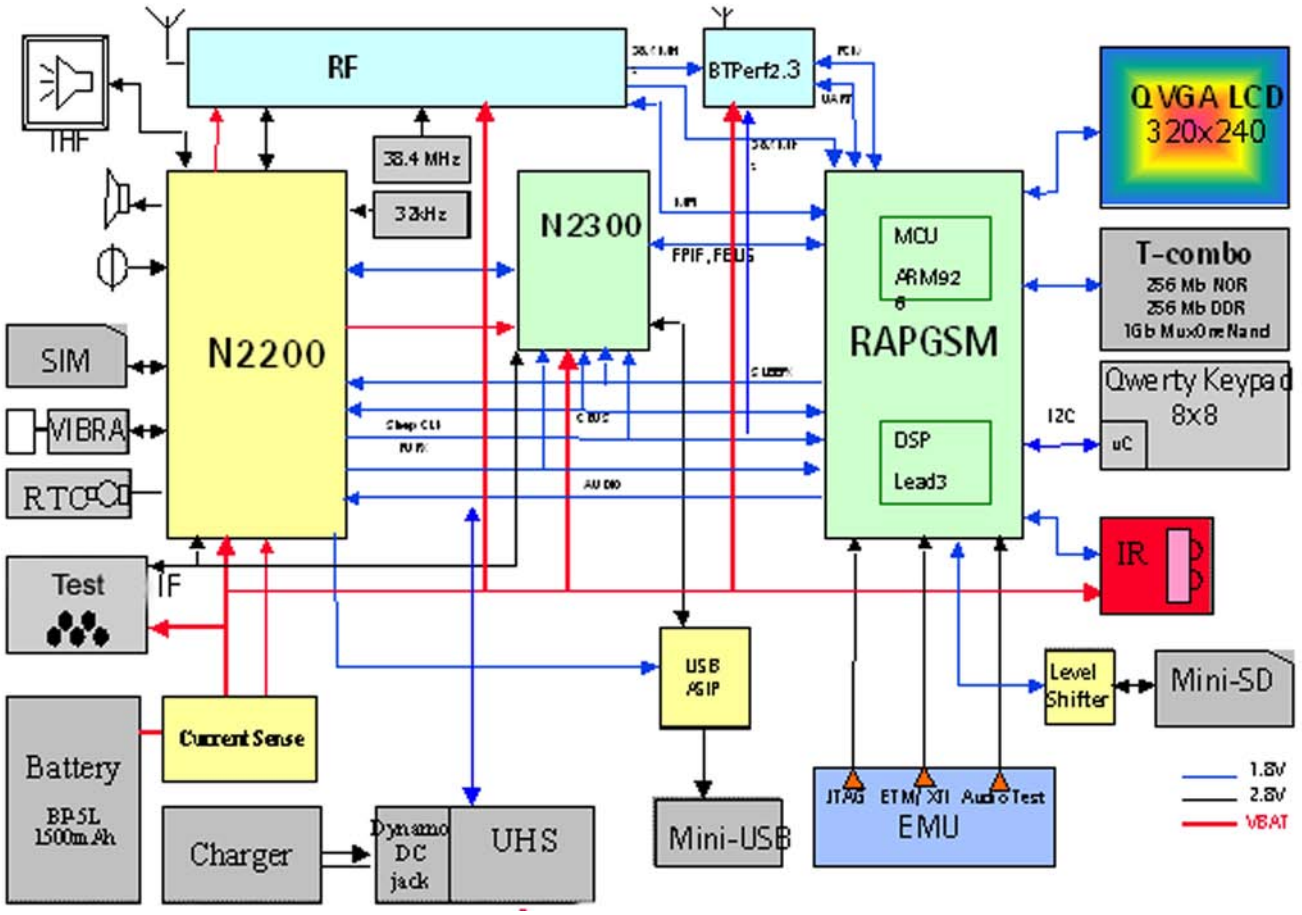


Figure 52 System level block diagram

Baseband functional description

Digital baseband is single processor architecture. It consists of RAP, EM ASIC (N2200), EM ASIC (N2300) and memories as the core. RAP is a GSM EDGE chip with lots of peripheral features. Supported cellular protocols in RAP are GSM (minimum EDGE class 10, GPRS phase2). In general RAP consists of three separate parts. The first part is processor subsystem (PSS) that includes both MCU and DSP processors and related functions. The second part is MCU peripherals that are peripherals mainly controlled by MCU. The third one is DSP peripherals that are peripherals mainly controlled by DSP. N2200 is an audio ASIC including also energy management (EM) functions. With second EM ASIC N2300, it covers the analog audio and energy management function. N2200 is also the device that handles the power-up and power-down routines of the system. During the times when the digital BB is alive N2200 handles a variety of tasks that can not be accomplished elsewhere due to voltage requirements, noise etc. N2300 power IC is intended for energy management control, supply voltage generation and charge control of mobile phone. N2300 has a step down type (buck) programmable switch mode regulator for digital core supply generation, up (boost) switch mode regulator with current control for led supply, charge control circuitry with integrated switch, level shifters and regulator for FBUS/ USB-OTG, and digital circuitry including registers. Stacked triple combo memory (RAM, Nor, Nand in one package) includes 256Mbit DDR SDRAM , 256Mbit NOR Flash and 1Gbit Mux-One Nand.

Absolute maximum ratings

Signal	Min	Nom	Max	Unit	Notes
Battery voltage (idle)	-0.3		5.2	V	Battery voltage maximum value is specified during charging is active

Signal	Min	Nom	Max	Unit	Notes
Battery voltage (Call)	+3.2		+4.8	V	Battery voltage maximum value is specified during charging is active
Charger input voltage	-0.3		+16	V	

Phone modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2200 master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. In this mode certain regulators are enabled and after they and RFClk have stabilized, the system reset (PurX) is released and PWR_ON mode entered. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16 ms).
DEEP SLEEP	Deep sleep mode is entered only from Pwr_on mode with the aid of sw when the system's activity is low. At deep sleep, VCTCXO is powering off. System is running with the sleep clock. Regulators are in sleep mode.
FLASHING	FLASHING mode is for SW downloading.

Voltage limits

Parameter	Description	Value
VMSTR	Master reset threshold (N2200)	2.2V (typ.)
VMSTR+	Master reset threshold level, rising (N2300)	2.1V (typ.)
VMSTR-	Master reset threshold level, falling (N2300)	1.9V (typ.)
VCOFF+	Hardware cutoff (rising)	2.9V (typ.)

Parameter	Description	Value
VCOFF-	Hardware cutoff (falling)	2.6V (typ.)
SWCOFF	SW cutoff limit	~3.2V

The master reset threshold controls the internal reset of N2200 / (N2300). If battery voltage is above VMSTR, N2300's charging control logic is alive. Also, RTC is active and supplied from the main battery. Above VMSTR, N2300 allows the system to be powered on although this may not succeed due to voltage drops during start up. SW can also consider battery voltage too low for operation and power down the system.

Power key

The system boots up when power key is pressed (adequate battery voltage, VBAT, present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW).

Operation modes

There are four different power up possibilities to switch power on:

- Power key is pressed
- Charger is connected
- A pulse is supplied to MBUS line (Clk)
- Internal power up with Real Time Clock alarm.

  Power is not switched on by supplying battery voltage as in DCT4 generations

It should be noted that system behavior depends on the type of device the engine is in. The difference is mainly in the power key concept, basically:

- The power key controls the system power ON/OFF
- The system boots up always when not empty battery is connected. The power key controls only the CMT functionality. PDA functions are always available
- To the EM ASIC's functionality there is no difference how the power key is connected (the power up and down signaling and timings are the same)

Power distribution

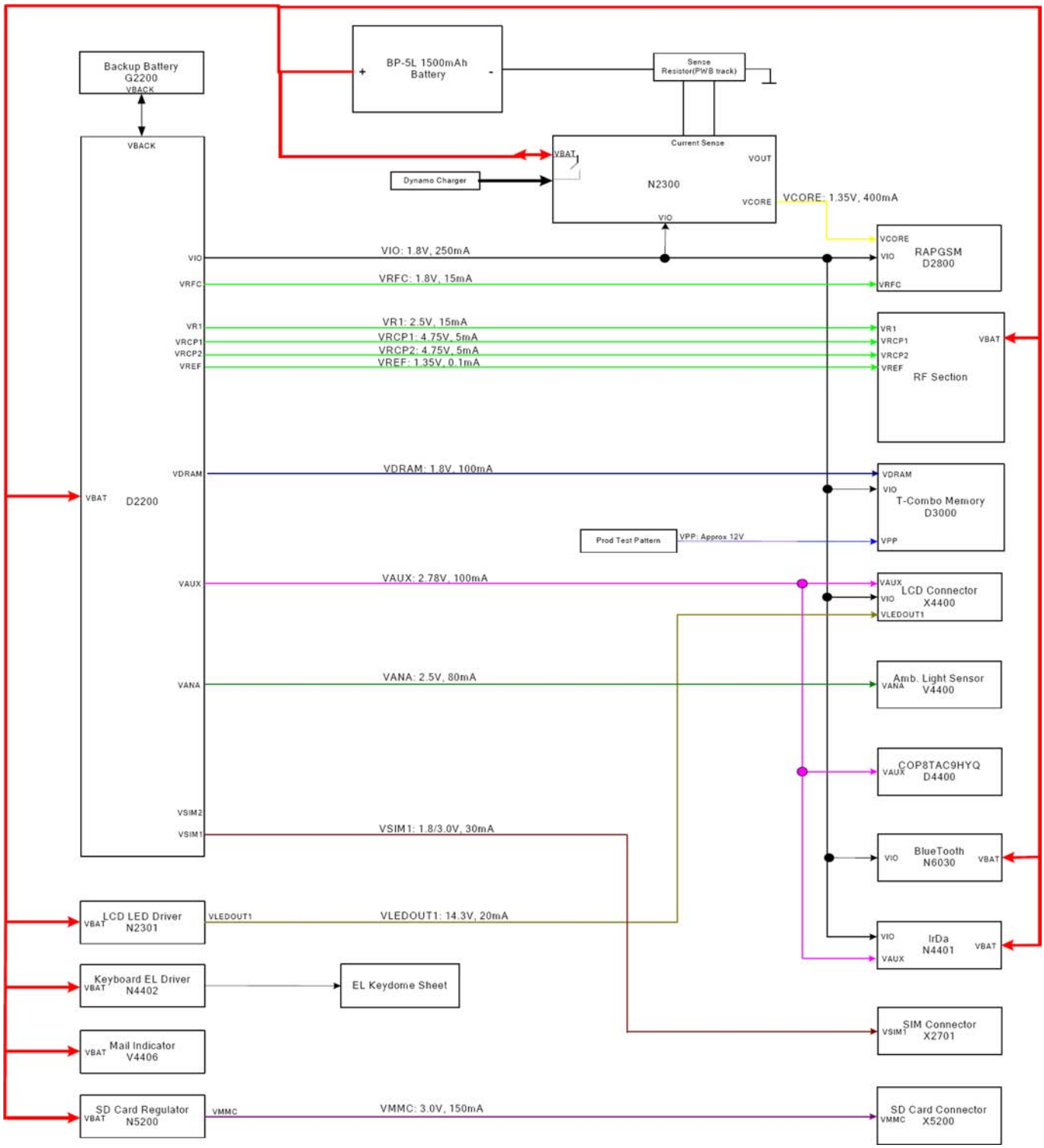


Figure 53 Power distribution diagram

System power-up

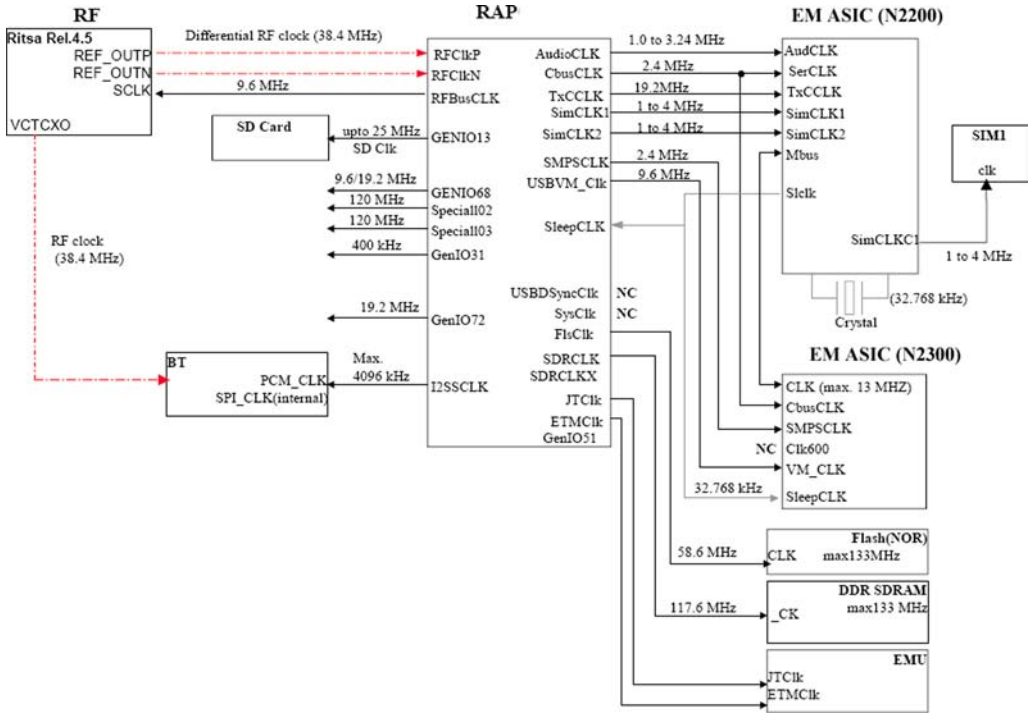
Power up procedure starts when the user presses power key (option 1) or when (not empty) battery is attached (option 2). In addition, some other triggers may start the system.

Power down procedure

Controlled powering off is done with the aid of SW when the user requests it or when the battery voltage is falling too low. Uncontrolled powering off happens for example when battery is suddenly removed.

Clocking scheme

The main system clock is a small signal sine wave created in the RF-section of the engine with Voltage Controlled, Temperature Compensated, crystal oscillator (VCTCXO). The delivered frequency is 38.4MHz . RAP has its own sleep mode in which use low accuracy, low frequency sleep clock instead of RF clock. In deep sleep, ASIC is sleep mode and therefore VCTCXO can be switched off (VCTCXO is a significant power consumer). In deep sleep also the core voltage is decreased.



Bluetooth

The device uses BTH Perf2.3 solution. The Bluetooth is V 2.0 + EDR. The Bluetooth module is implemented by using CSR's BC4-ROM. BlueCore-4 ROM is a single chip radio and baseband IC for Bluetooth 2.4 GHz systems.

In BB5.0 ,BT interface has been designed so that it allows attaching BT modules from different vendors. The interface consists of UART interface and PCM interface for audio.

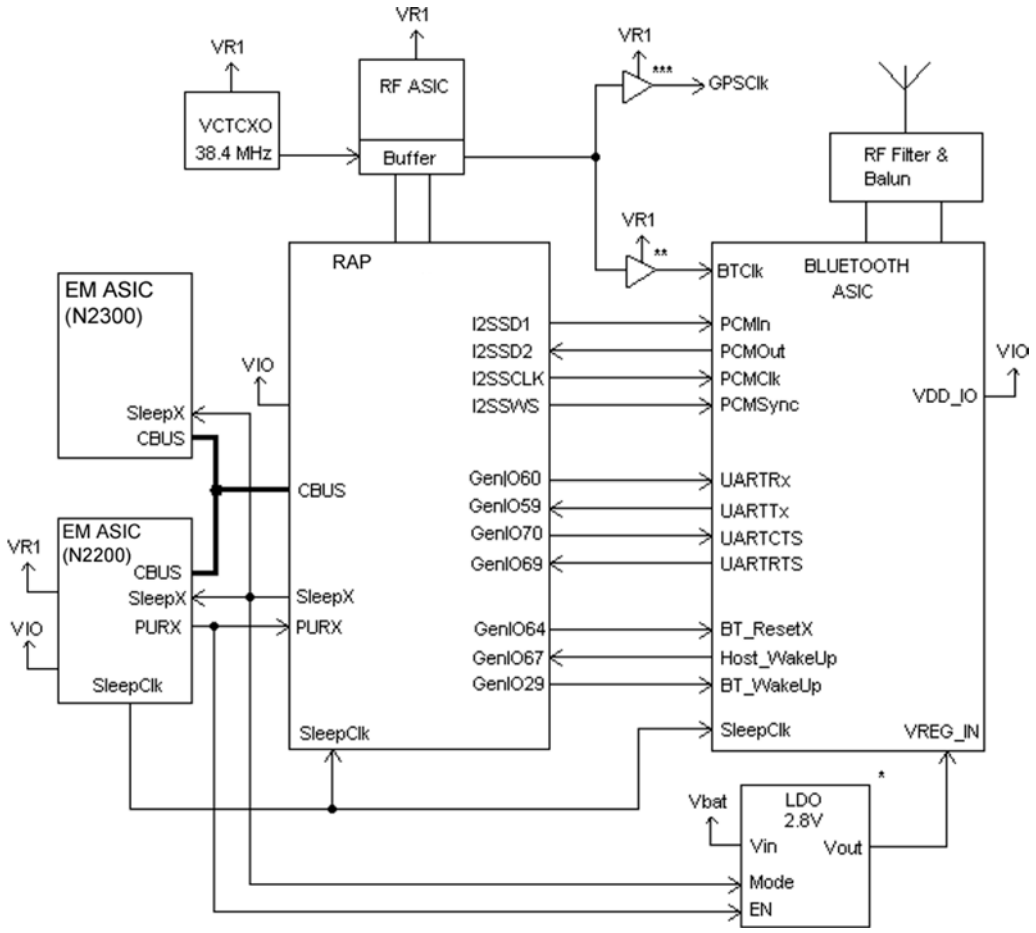


Figure 54 BT-RAP connection

IrDA

IrDA specifies a reliable, fully digital peer-to-peer data link between IrDA units at data rates from 9600 bits/s to 115 kbit/s. The link is based on the serial transmission of data as pulses of infra red light at the wave length of 870nm and angles of +-15degrees at the range 0 - 50 to 100 cm. The transmission is not omnidirectional but focused and only reaches a peer at a limited line-of-sight distance from the transmitter thus not disturbing any other units in the neighbourhood.

IR communication is half-duplex e.g. the IR receiver sees its own transmission, and the IR interface is either transmitting or receiving, but not both at once.

USB

USB (Universal Serial Bus) provides a wired connectivity between a USB host PC and peripheral devices.

USB is a differential serial bus for USB devices. USB controller supports USB specification revision 2.0 with full speed USB (12 Mbps). The device is connected to the USB host through the system connector. The USB bus is hot plugged capable, which means that USB devices may be plugged in/out at any time.

SIM card

The device SIM interface supports both1.8V and 3V technology smart cards.

The power is not allowed to be supplied to cards until the power contacts to battery are properly connected.

RF-BB interface

In BB-RF interface there are 19 signal pins between RAP and cellular RF.

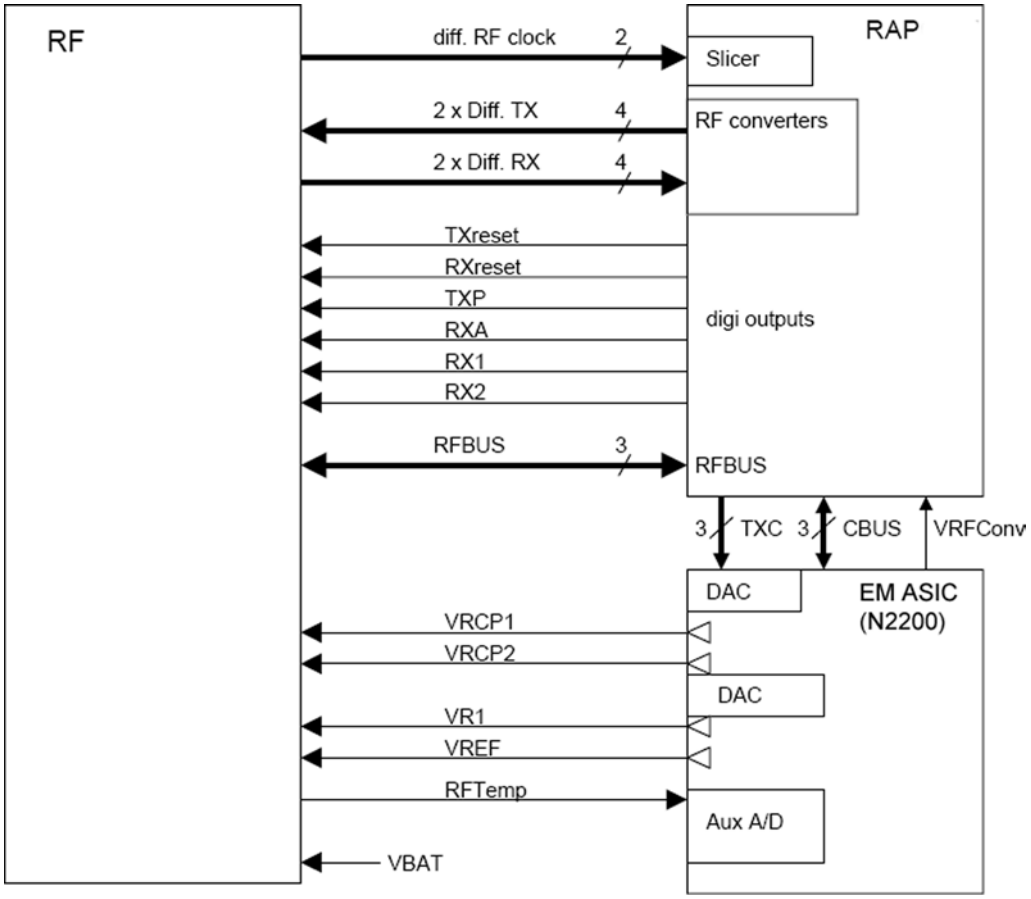
Between EM (N2200) and cellular RF there are 8 pins + VBAT. RF is controlled directly by RAP and N2200. Digital control signals, such as RFBus and reset signals, are taken from RAP and analog control signals, such as AFC and TxC, are taken from EM ASIC (N2200).

RFBUS is similar control bus than CBUS and DBUS, but it is only used as controlling interface between RF and BaseBand (RAP). RAP controls AFC and TxC signals via TxCData bus and RF regulator control is done via CBUS.

Analog Rx and Tx signals are connected to/from RAP that includes RF converters for this purpose. The TxC serial bus interface is a one-way bus, which is used to transfer data from RAP3G to the N2200 ASIC TXC DACs.

These DACs are used to control the RF power amplifiers. The TXC bus includes TxCCtrl pin, which is used to select the EM ASIC (N2200) DAC, the data is written to. In case the TxCCtrl is in low state, the data is written to the DAC1 and in case the TxCCtrl is in high state, the data is written to DAC2.

The TxC bus clock frequency is programmable but the frequency to be used in CeBBo1 is 19.2 MHz and for RFBUS the frequency used is 9.6 MHz.



FBUS

USB and FBUS have multiplexed interface between EM ASIC (2300) and RAP.

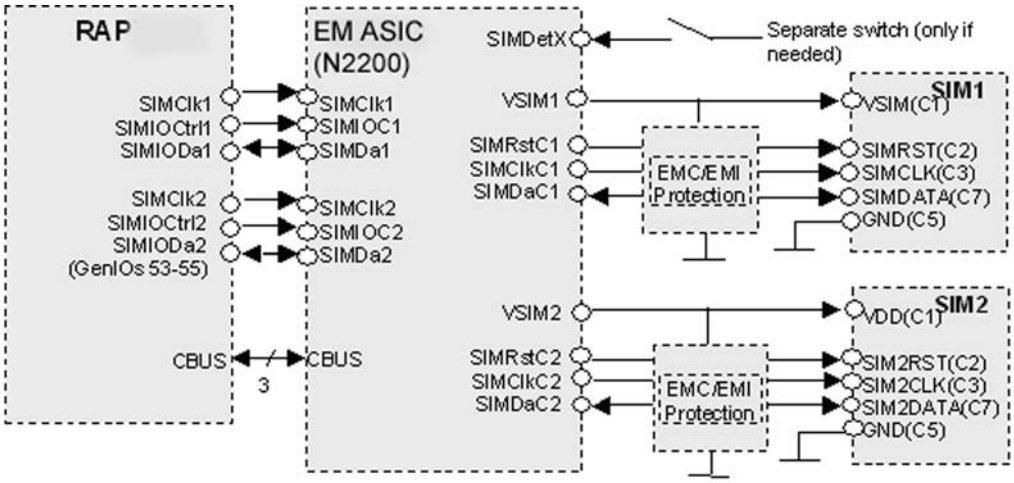
ACI interface

The ACI (Accessory Control Interface) is a point-to-point, bi-directional, single line serial bus.

It has two main features: the insertion and removal detection of an accessory device and acting as a data bus between phone and accessory, intended for control purposes. A third function of ACI is to identify and authenticate the accessory.

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.



The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

MiniSD interface

In the RAP the MMC/SD interface is multiplexed with NAND Flash and SIM2 interfaces.

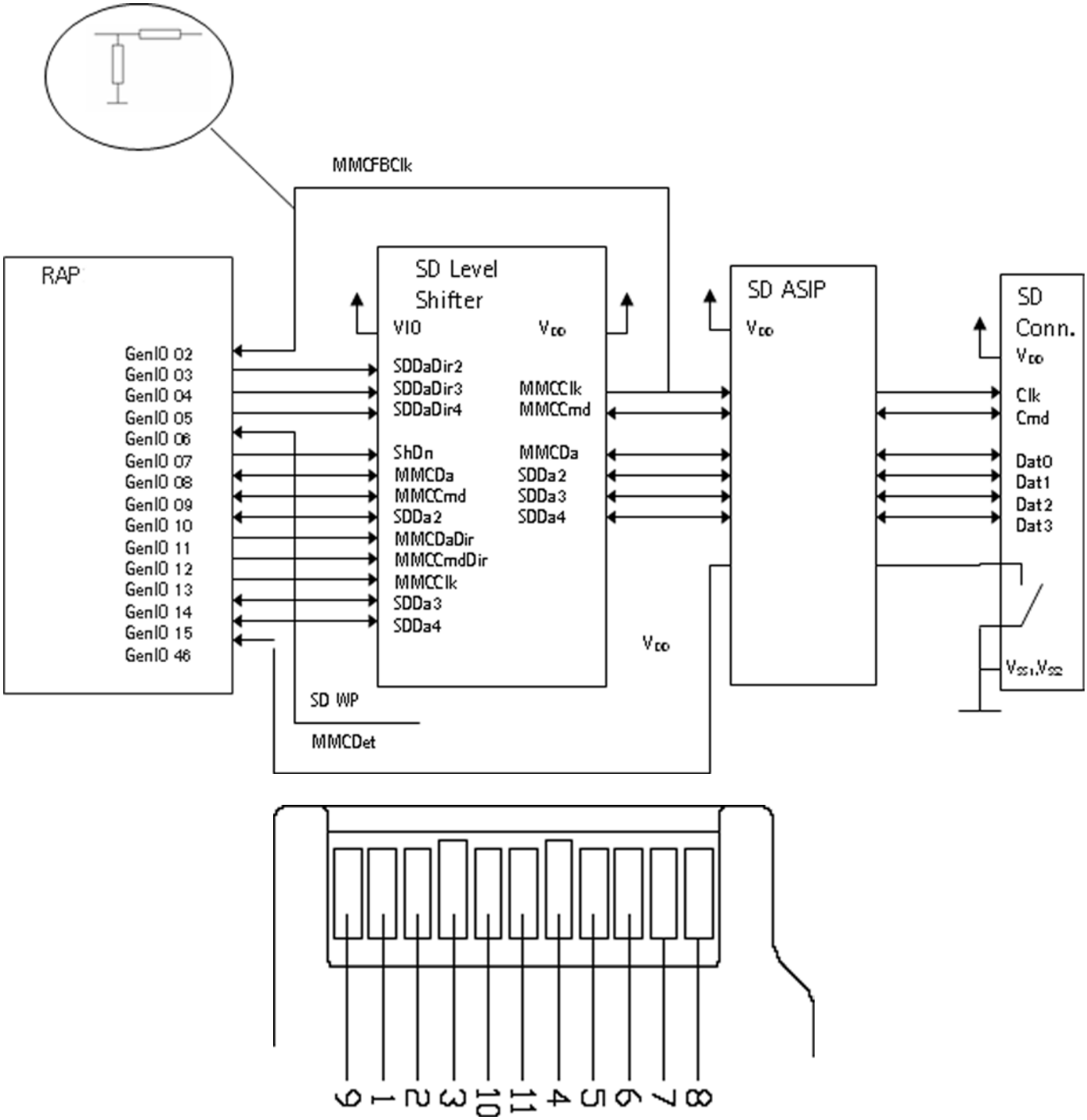


Figure 55 MiniSD contact area & pin order

Battery interface

The battery interface supports a 3-pole battery interface. The interface consists of three connectors: VBAT, BSI and GND.

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

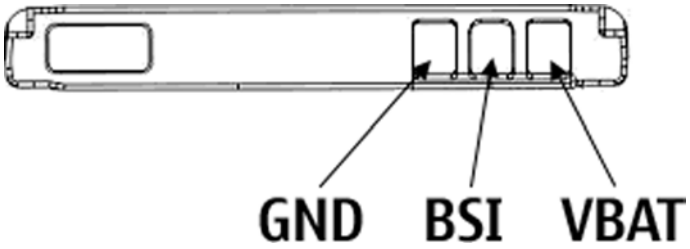


Figure 56 Battery pin order

Table 14 Battery interface connections

Pin	Signal	I/O	Engine connection		Notes
1	VBAT	->	EM ASIC N2200	VBAT	Battery voltage
2	BSI	->	EM ASIC N2200	BSI	Battery size indication (fixed resistor inside the battery pack)
3	GND		GND		Ground

Battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line, which is located on the transceiver PWB.

For service purposes, the device SW can be forced into local mode by using pull down resistors connected to the BSI line.

User interface

Display interface

The device supports Oxford QVGA 2.8" TFT display with 320 x 240 resolution and 24bit colors. It uses 8-bit display interface.

Keyboard

The device uses external COP8 micro controller to handle engine & qwerty keyboard matrix. The communication between COP8 and RAP is handled by I2C bus.

Display and keyboard backlight

The device has one LED Driver (SMPS) that is used to drive six display LEDs.

Display LEDs are connected in to two three LED series. Current adjustment of the driver is done from the display LED branch, and keyboard current also depends on the display brightness. In a typical use case, keyboard LEDs are turned ON only in dark ambient lighting conditions.

The keyboard backlight is made with electroluminance. The device has discrete EL-driver, which provide backlight for keyboard.

ALS interface

Ambient Light Sensor (ALS) is located in the upper part of the phone. It consists of the following components:

- lightguide (part of the front cover)
- phototransistor (V4400) + resistor (R4401)
- NTC + resistors (R4400, R4402, R4403)

- EM ASIC (N2200)

Information on ambient lighting is used to control the backlights of the phone:

- Keypad lighting is switched on only when the environment is dark / dim
- Display backlights are dimmed, when the environment is dark / dim

The ambient light sensor itself is a photo transistor, which is temperature-compensated by an external NTC resistor. N2200 reads the light sensor (LS) and temperature (LST) results.

ALS calibration is not possible in the service points. ALS is serviced by replacing faulty phototransistors.

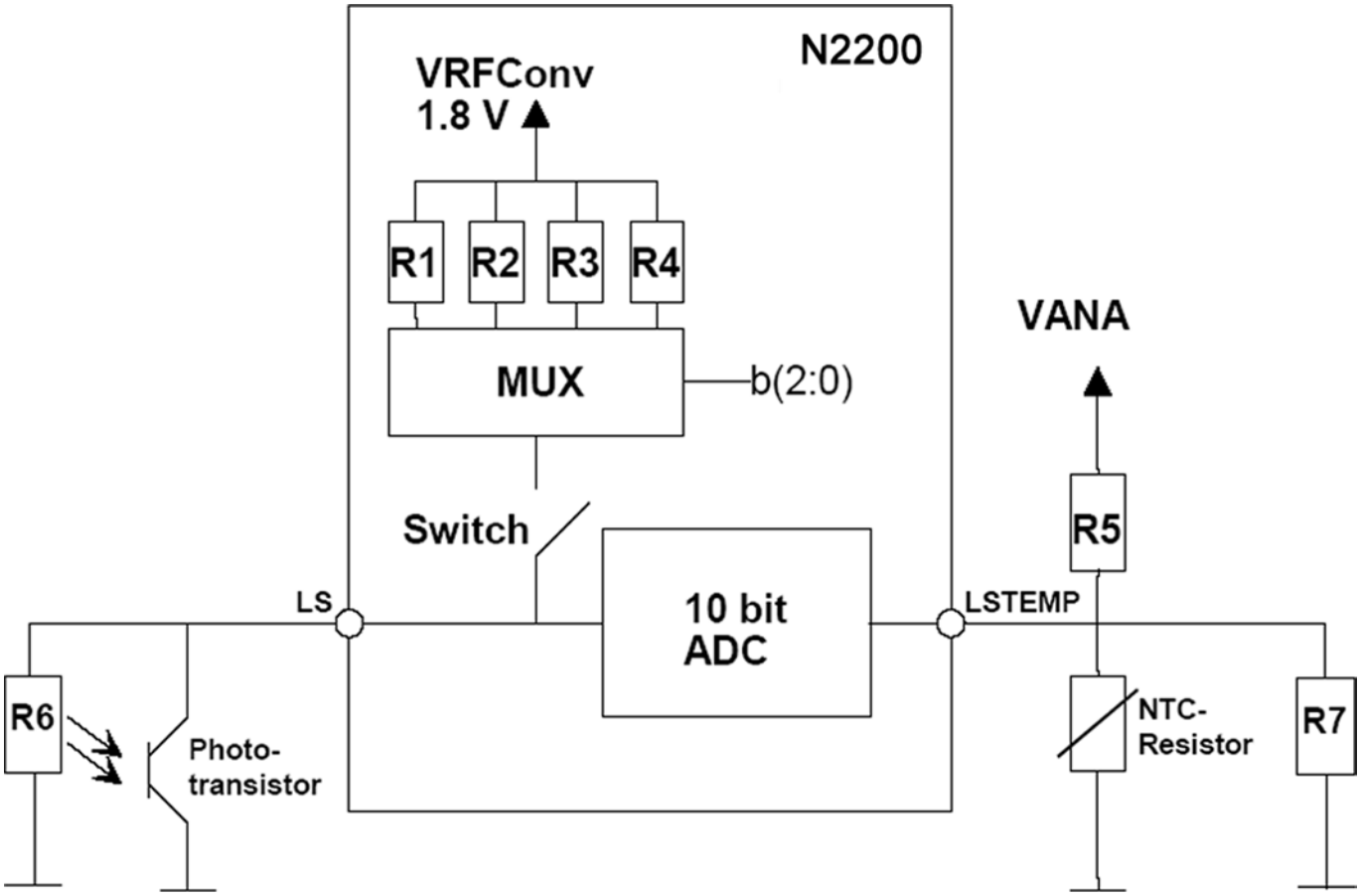


Figure 57 ALS HW implementation

Table 15 ALS resistor values

Symbol	R1	R2	R3	R4	R5	R6	R7	NTC-res
Value	5 kOhm	15 kOhm	30 kOhm	50 kOhm	470 kOhm	100 kohm	470 kohm	47 kOhm

E-Mail LED

The device has E-Mail indicator LED.

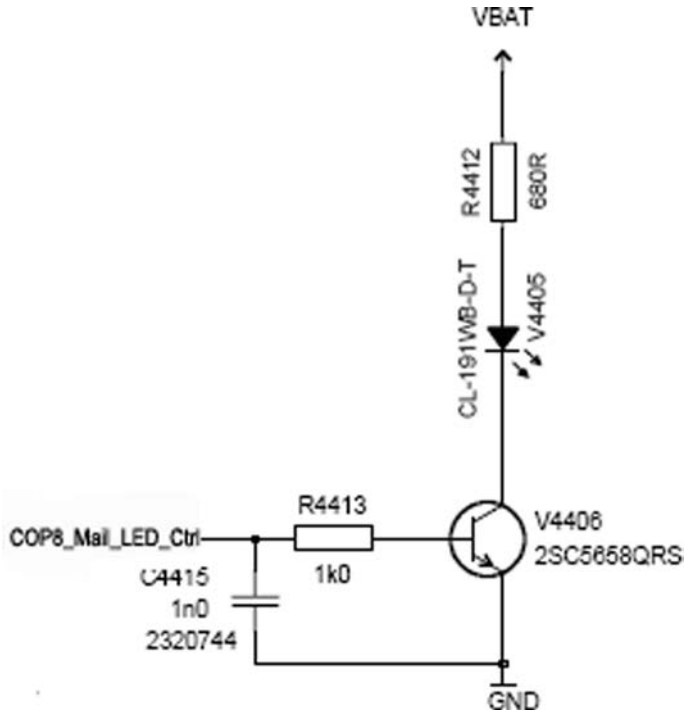


Figure 58 E-mail LED implementation

Audio concept

Audio HW architecture

In BB5.0, the digital functions of audio are integrated into RAP and analogue functions into EM ASIC N2200.

Audio codec supports 48 kHz and 44.1 kHz sampling rates in addition to 40 kHz, which provides full 20 kHz audio bandwidth (near CD quality) in Rx path.

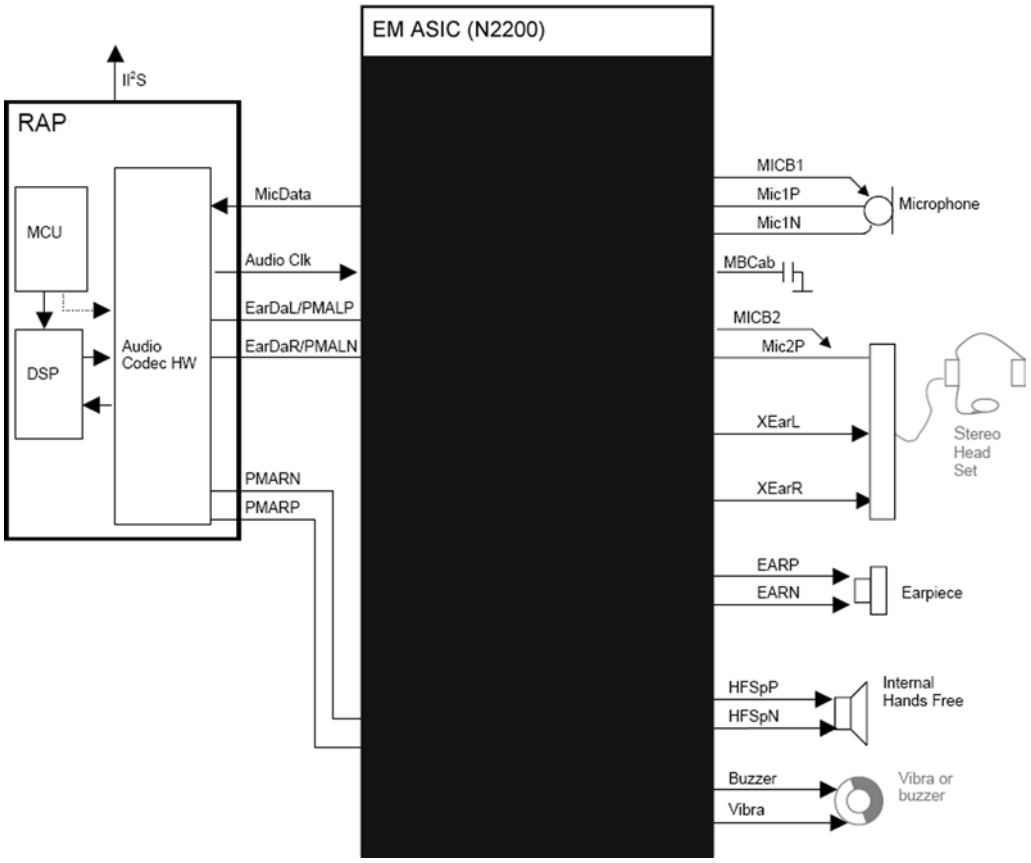


Figure 59 Audio block diagram

Internal microphone

Internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to Retu ASIC's Mic1P and Mic1N is connected ground near Retu.

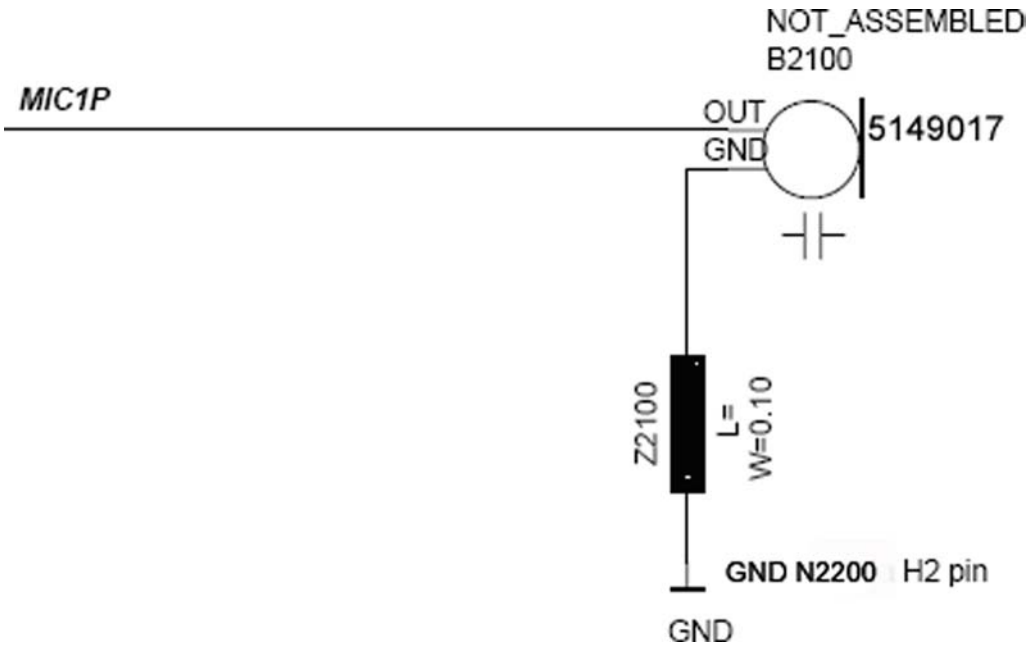


Figure 60 Internal microphone passive circuitry

Internal earpiece

The internal earpiece is used in the HandPortable (HP) call mode. A dynamic 7x11 mm earpiece capsule is connected to N2200 ASIC's differential outputs EarP and EarN.

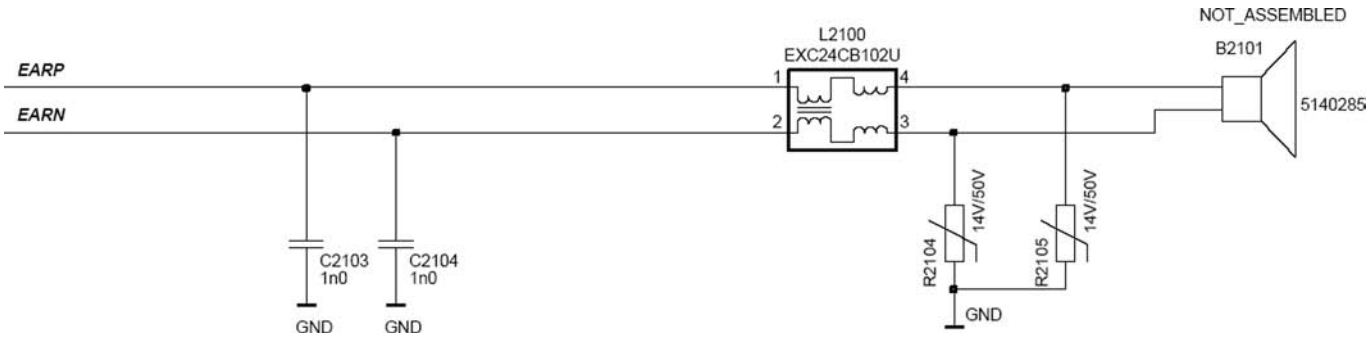


Figure 61 Internal earpiece circuitry

Internal speaker

The internal speaker is used in Internal HandsFree (IHF) call mode.

A dynamic 20 mm speaker is connected to N2200 ASIC's outputs HFSpP and HFSpN.

The IHF amplifier integrated in EM ASIC N2200 is a Digital Pulse Modulated Amplifier (DPMA).

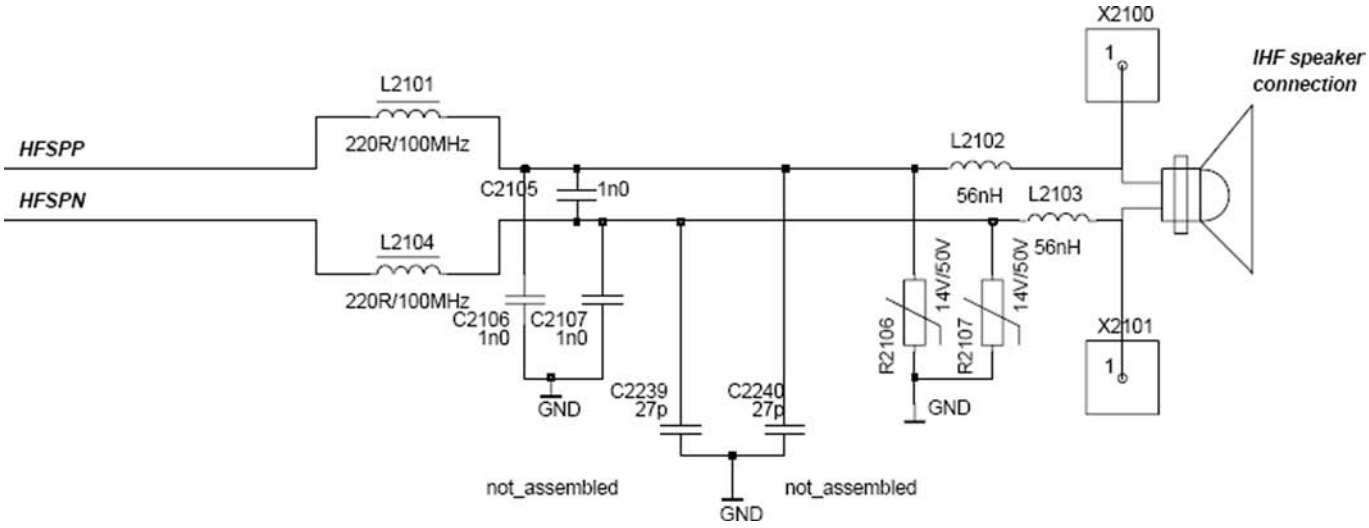


Figure 62 Internal speaker circuitry

Vibra circuitry

Vibra is used for vibra-alarm function.

The vibra motor is connected to the N2200 ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

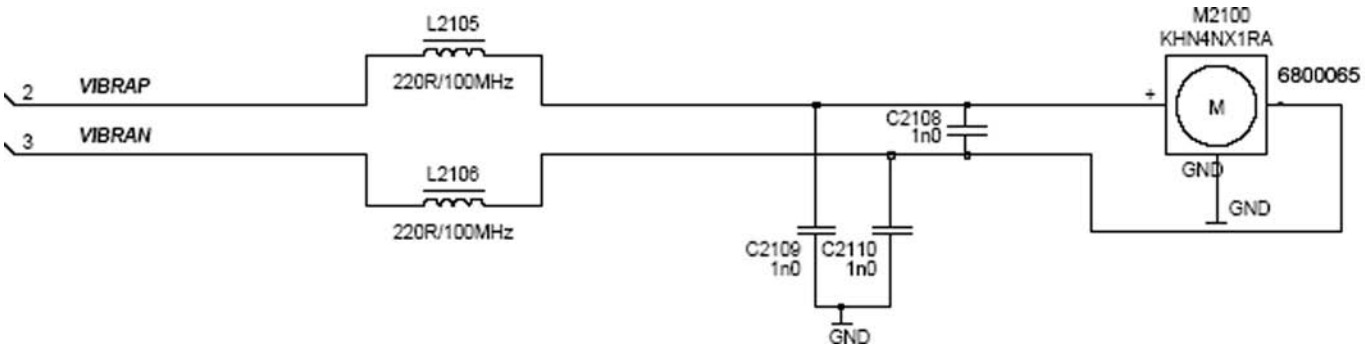


Figure 63 Vibra circuitry

Baseband technical specifications

External interfaces

Name of Connection	Connector reference
USB	X2001
Charger	X2000
Headset	X2002
SIM	X2700
MiniSD	X5200
Battery connector	X2070

USB IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Absolute maximum voltage on D+ and D-	$V_{D+/D-}$	-1	4.6	V	USB specification revision 2.0
Supply voltage	VBUS	4.4	5.25	V	
Supply current:					
Functioning	I_{VBUS}		100	mA	
Suspended	I_{VBUS}		500	uA	
Unconfigured	I_{VBUS}		100	mA	
High-level input voltage:				V	
High (driven)	V_{IH}	2			
High (floating)	V_{IHZ}	2.7	3.6		
Low-level input voltage	V_{IL}		0.8	V	

Description	Parameter	Min	Max	Unit	Notes
Differential input sensitivity	V_{DI}	0.2		V	|(D+) - (D-)|
Differential input voltage range	V_{CM}	0.8	2.5	V	Included VDI range
Low-level output voltage	V_{OL}	0	0.3	V	
High-level output voltage (driven)	V_{OH}	2.8	3.6	V	
Output signal crossover voltage	V_{CRS}	1.3	2	V	

FBUS interface electrical characteristics (between RAP and N2300)

Description	Parameter	Min	Max	Unit
High-level input voltage	V_{IH}	0.7 x V_{DDSHV2}	V_{DDSHV2}	V
Low-level Input voltage	V_{IL}	0	0.3 x V_{DDSHV2}	V
High-level output voltage	V_{OH}	0.8 x V_{DDSHV2}	V_{DDSHV2}	V
Low-level output voltage	V_{OL}	0	0.22 x V_{DDSHV2}	V
Rise/fall time	tR/tF	0	25	ns
(VDDSHV2 = 1.8V)				

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	N2200	VSIM1	Supply voltage to SIM card, 1.8 V or 3.0 V.
C2	SIMRST	Out	N2200	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	N2200	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	N2200	SIM1DaC	Data input / output

MiniSD interface connections

Signal name/ RAP3G	Signal name/ SD Card	Signal Properties Direction -- Levels -- Freq./Timing Resolution			Description / Notes
GenIO 09 or GenIO 54	MMCCmd	<>	0-1.8 V / 0-3.6V		SD Command
GenIO 13 or GenIO 53	MMCClk	>	0-1.8 V / 0-3.6V	Max 25 MHz	SD Clock
GenIO 08 or GenIO 55	MMCDa	<>	0-1.8 V / 0-3.6V		SD Data bit 0
GenIO 07	MMCLSShutDn	>	0-1.8 V / 0-3.6V		Level shifter shutdown
GenIO 10	SDDa2	< >	0-1.8 V / 0-3.6V		Data bit 1
GenIO 14	SDDa3	< >	0-1.8 V / 0-3.6V		Data bit 2
GenIO 15	SDDa4	< >	0-1.8 V / 0-3.6V		Data bit 3
GenIO 12 or GenIO 65	MMCCmd Dir	>	0-1.8 V / 0-3.6V		Command Dir
GenIO 11 or GenIO 66	MMCDaDir	>	0-1.8 V / 0-3.6V		Data bit 0 Dir
GenIO 03	SDDaDir2	>	0-1.8 V / 0-3.6V		Data bit 1 Dir
GenIO 04	SDDaDir3	>	0-1.8 V / 0-3.6V		Data bit 2 Dir
GenIO 05	SDDaDir4	>	0-1.8 V / 0-3.6V		Data bit 3 Dir
GenIO 46	MMCDet	<	0-1.8 V / 0-3.6V		Card insert/ removal detection

Signal name/ RAP3G	Signal name/ SD Card	Signal Properties Direction -- Levels -- Freq./Timing Resolution			Description / Notes
GenIO 06	SD Write Protect	<	0-1.8 V / 0-3.6V		Write protect detection, used only with normal size SD Card
GenIO 02	MMCFBClk	<	0-1.8 V / 0-3.6V		Clock Feedback

Charger connector and charging interface connections & electrical characteristics

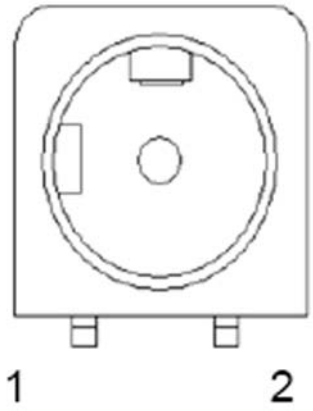


Figure 64 Charger connector

Table 16 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N2300	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 17 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	

Description	Parameter	Min	Max	Unit	Notes
Threshold for charging, rising (N2300)	V_{MSTR+}	2.1		V	Typical value
Threshold for charging, falling (N2300)	V_{MSTR-}	1.9		V	Typical value

Battery interface electrical characteristics

Table 18 Battery IF electrical characteristics

Description	Parameter	Max	Unit
Operation voltage	V_{IN}	4.23	VDC
Current rating	I_{IN}	0.9	A

Internal interfaces

Name of Connection	Connector reference
Joystick connector	X4500
Display	X4400
ALS	V4400
Vibra	M2100
Microphone	B2100
Earpiece	B2101
IHF speaker	B2102

I2C

I2C is an Inter IC bus and aimed for slow control of peripherals.

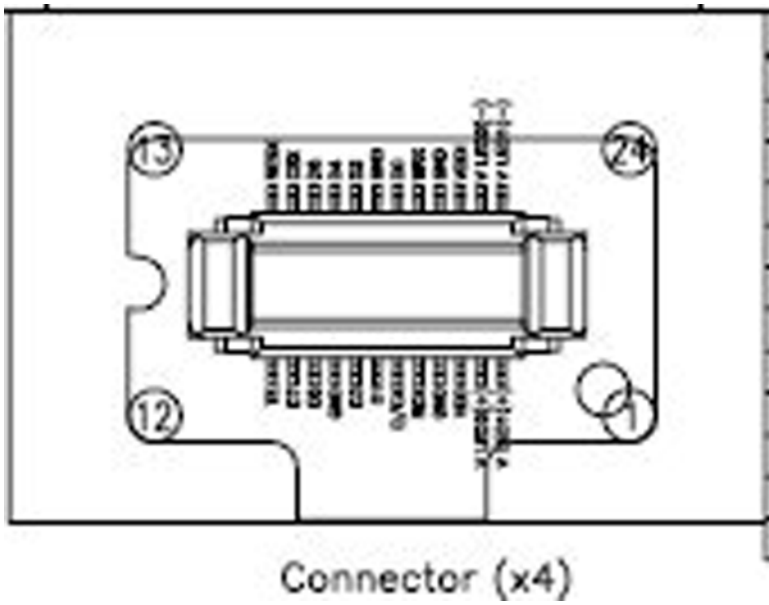
The device uses I2C to interconnect QWERTY keyboard controller to RAP.

Keyboard interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage	V_{IH}	0.65* V_{DDS}	V_{DDS}	0.3+ V_{DDS}	V	Row
Low-level input voltage	V_{IL}	-0.3	0	0.35* V_{DDS}	V	Row
High-level output voltage	V_{OH}	1.62	V_{DDS}	1.98	V	Column
Low-level output voltage	V_{OL}		0	0.45	V	Column

Description	Parameter	Min	Typ	Max	Unit	Notes
(VDDS = 1.8V)						

Display connector and interface connections



Connector (x4)

PIN#	Symbol	Symbol	PIN#
12	TE	RESX	13
11	D7	CSX	14
10	D5	D6	15
9	GND	D4	16
8	D3	D2	17
7	D1	GND	18
6	D/CX	D0	19
5	RDX	WRX	20
4	GND	GND	21
3	VDD	VDDI	22
2	V LED2(+)	V LED2(−)	23
1	V LED1(+)	V LED1(−)	24

Pin	Signal	I/O	Engine connection		Notes
1	V LED1 +	<-	N2301	VLEDout	N2301 is controlled by EM ASIC (N2300)
2	V LED2 +	<-	N2301	VLEDout	N2301 is controlled by EM ASIC (N2300)
3	VDD	<-	EM ASIC (N2200)	VAUX	Core Voltage
4	GND				
5	RDX	<-	RAP	Lcdrdx	Read Enable (active low)
6	D/CX	<-	RAP	Lcdrmd	Data/ Command select (high = data low = command)
7	D1	<->	RAP	Lcdda1	Data
8	D3	<->	RAP	Lcdda3	Data
9	GND				

Pin	Signal	I/O	Engine connection		Notes
10	D5	<->	RAP	Lcdda5	Data
11	D7	<->	RAP	Lcdda7	Data
12	TE	->	RAP	Te	Tearing Effect
13	RESX	<-	RAP	Gpio60	Reset (active low)
14	CSX	<-	RAP	Lcdsx	Chip Select (active low)
15	D6	<->	RAP	Lcdda6	Data
16	D4	<->	RAP	Lcdda4	Data
17	D2	<->	RAP	Lcdda2	Data
18	GND				
19	D0	<->	RAP	Lcdda0	Data
20	WRX	->	RAP	Lcdwrx	Write Enable (active low)
21	GND				
22	VDDI	<-	EM ASIC (N2200)	VIO	Interface voltage
23	V LED2 -	->	R2303	SETCURR1	Resistor
24	V LED1 -	->	R2303	SETCURR1	Resistor

Back-up battery interface electrical characteristics

Table 19 Back-up battery connections

Pin name	I/O	Connection	Notes
L2207, VBack	->	N2200, VBack	Back-up battery G2200 is connected to N2200 via coil

Table 20 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.7	V

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
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9 — Schematics

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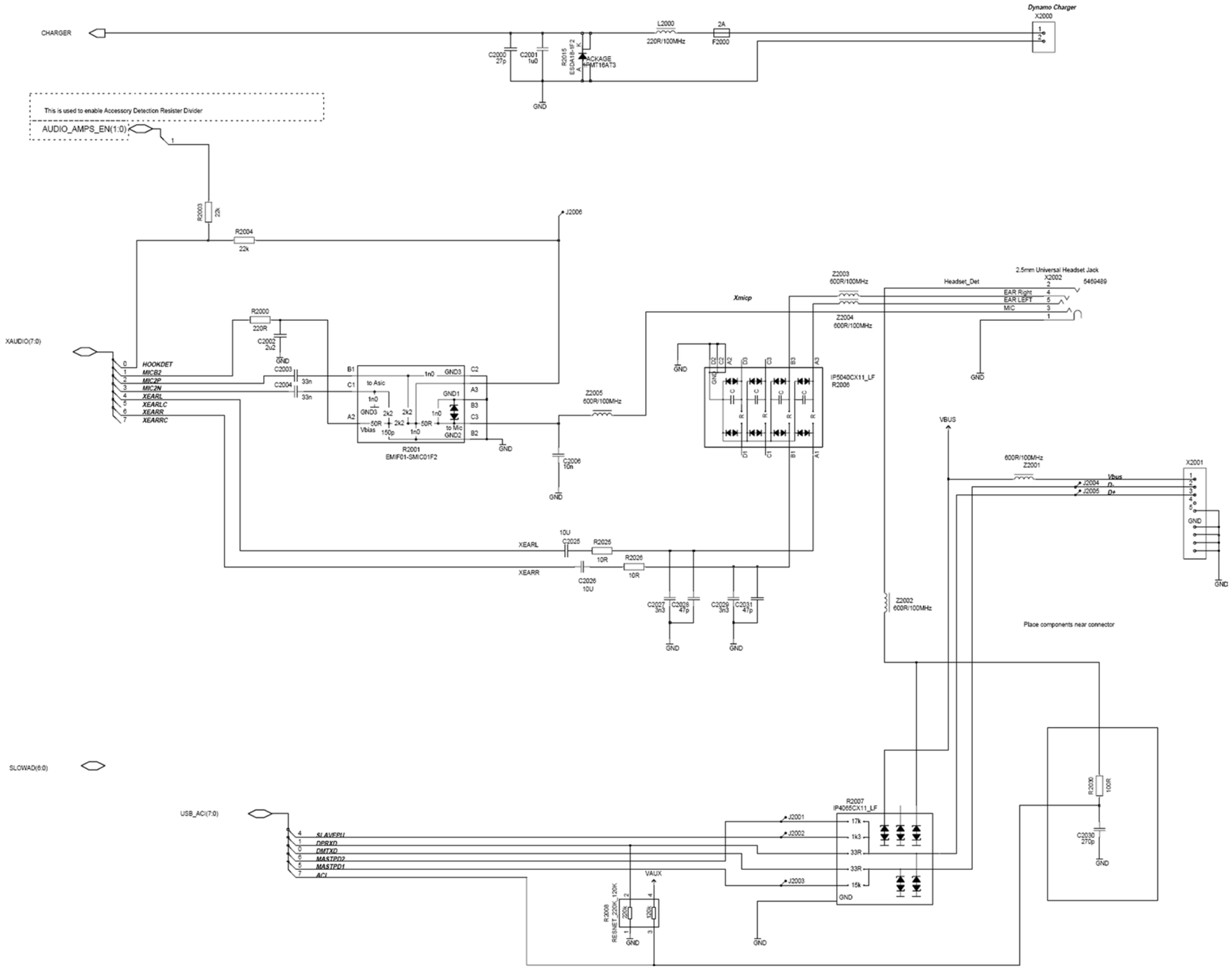
Table of Contents

System connector



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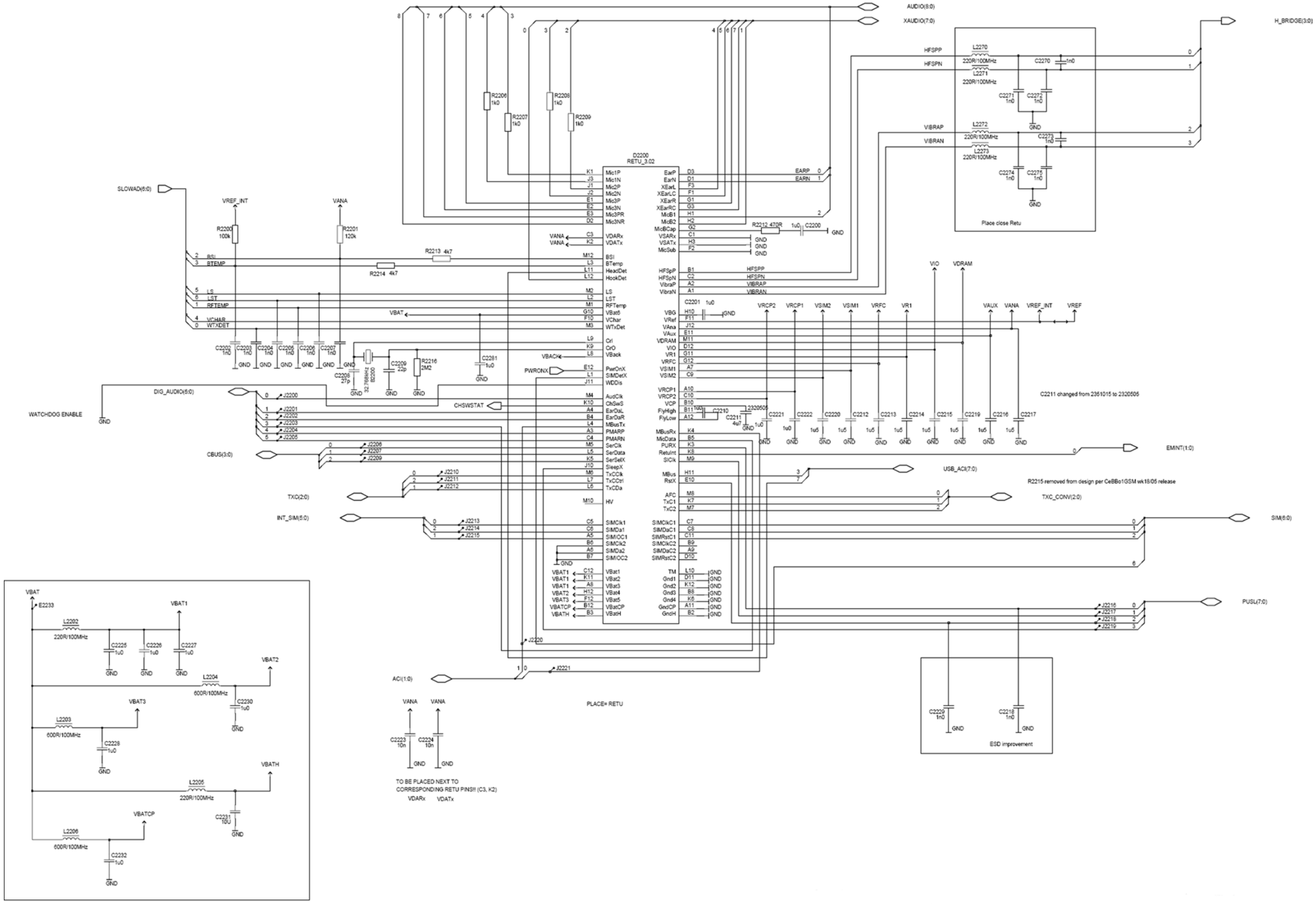

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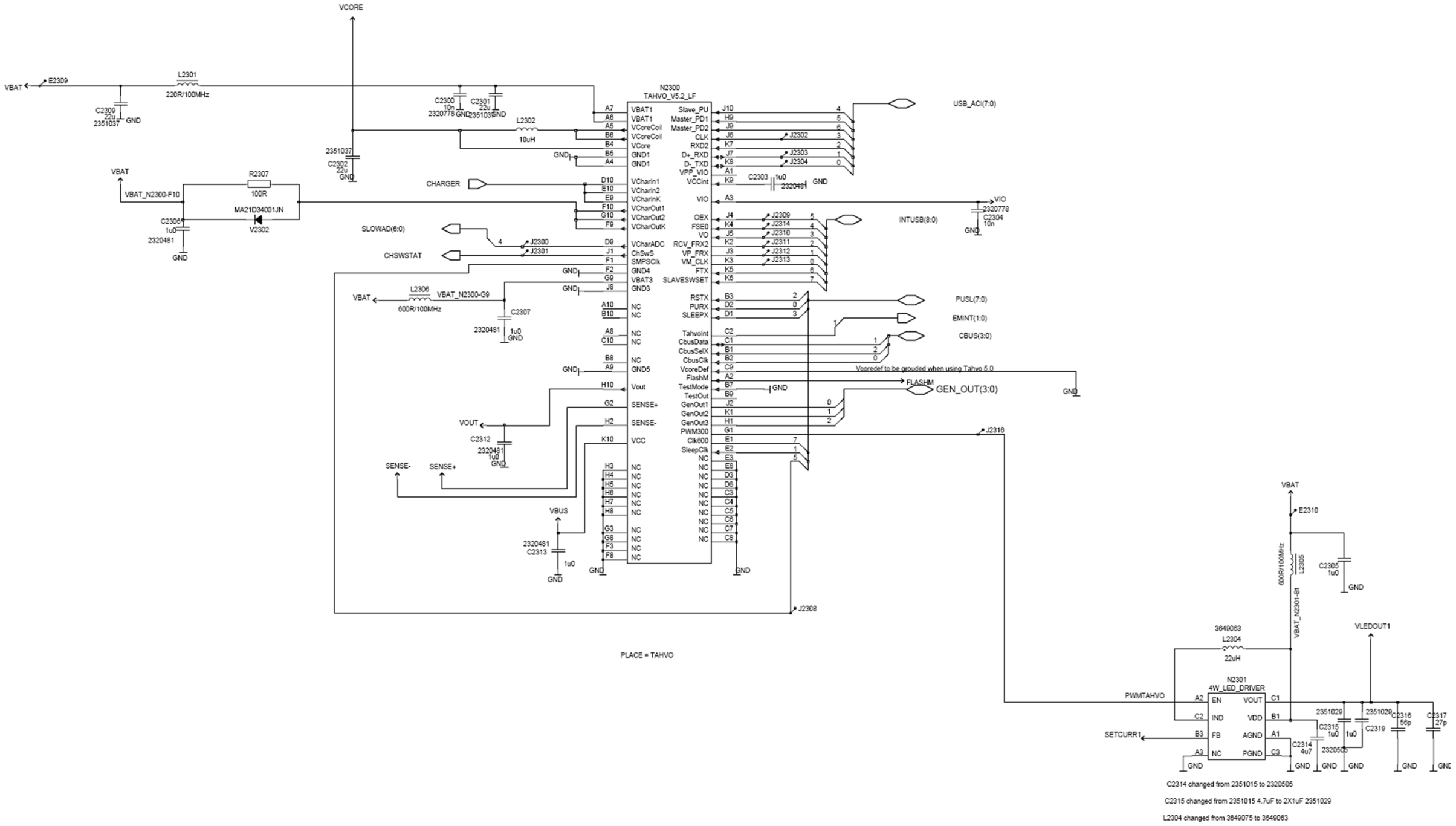

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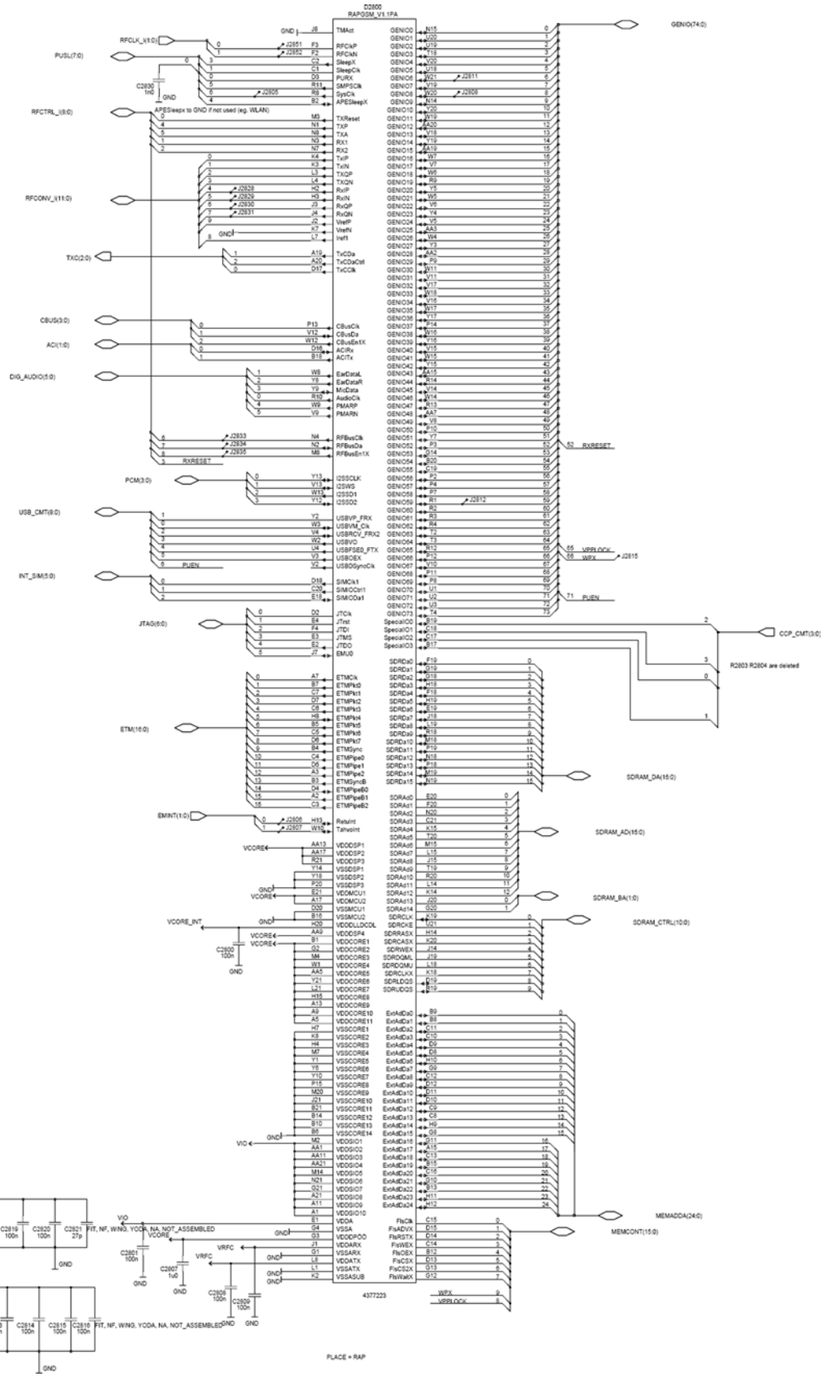

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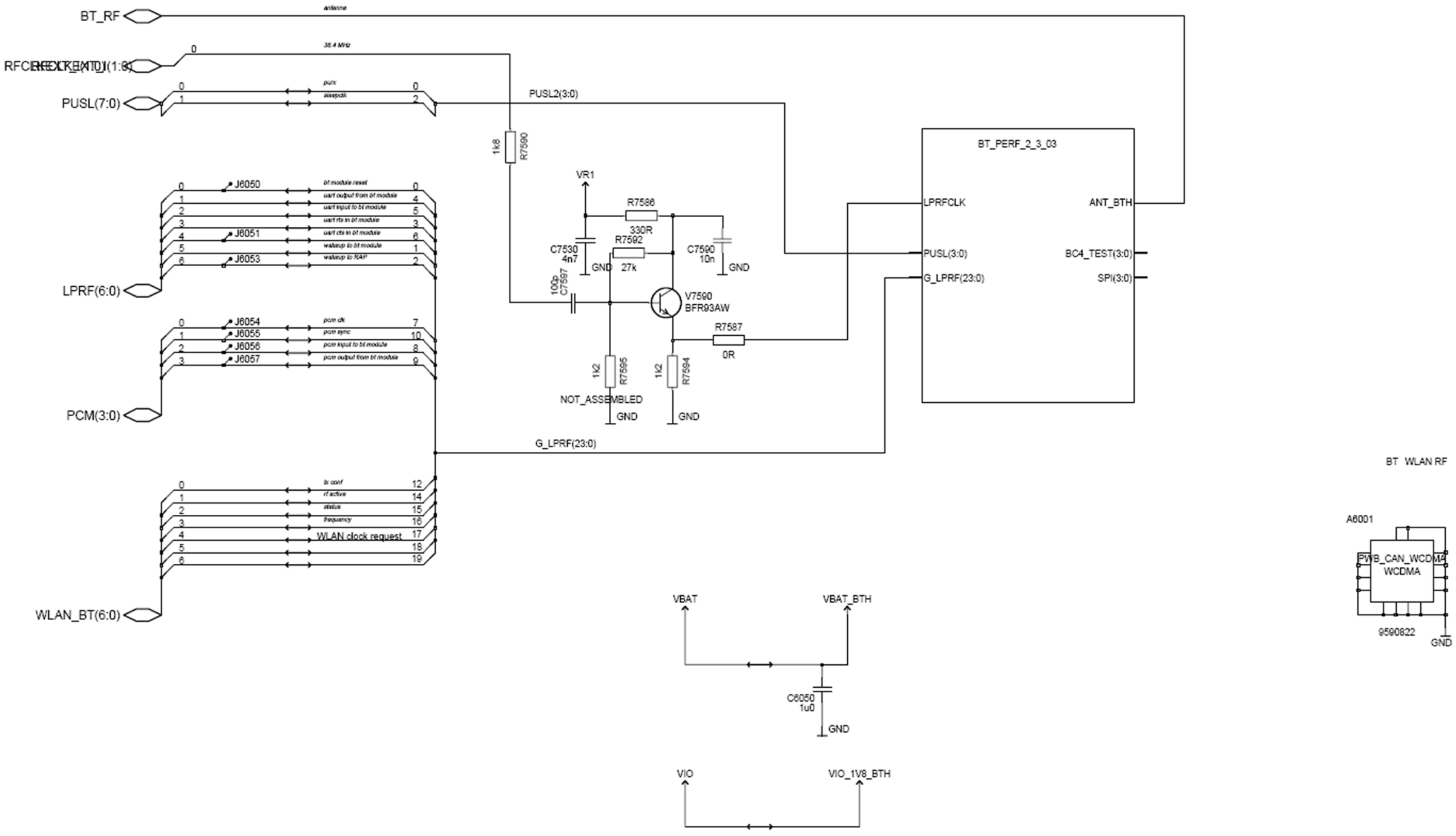

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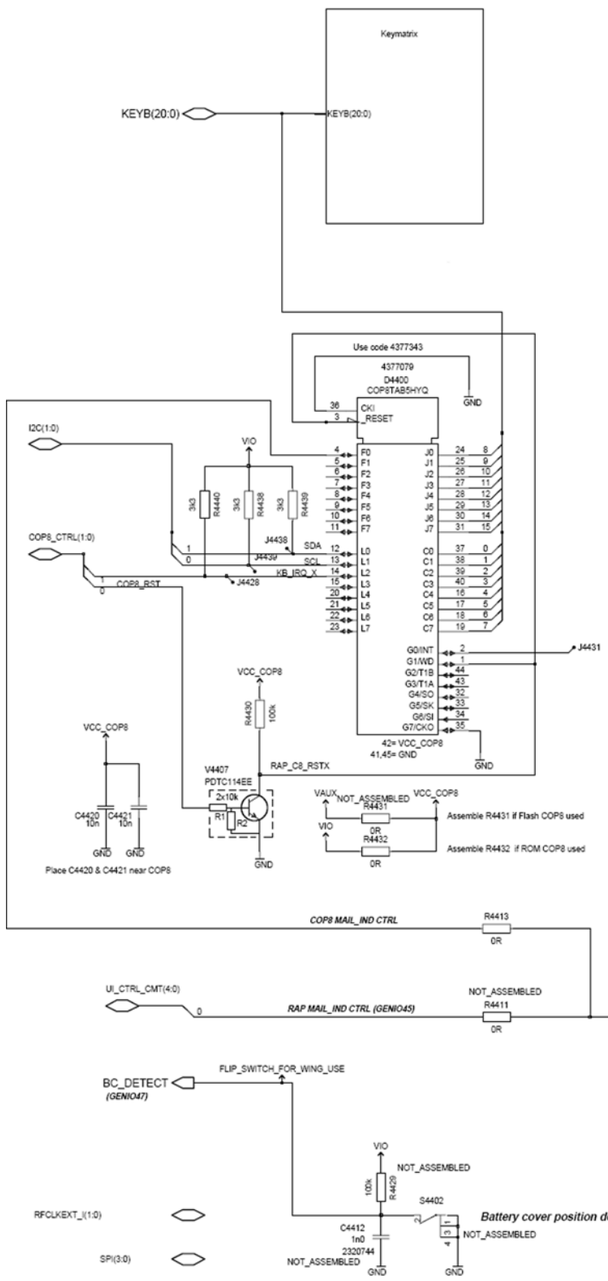

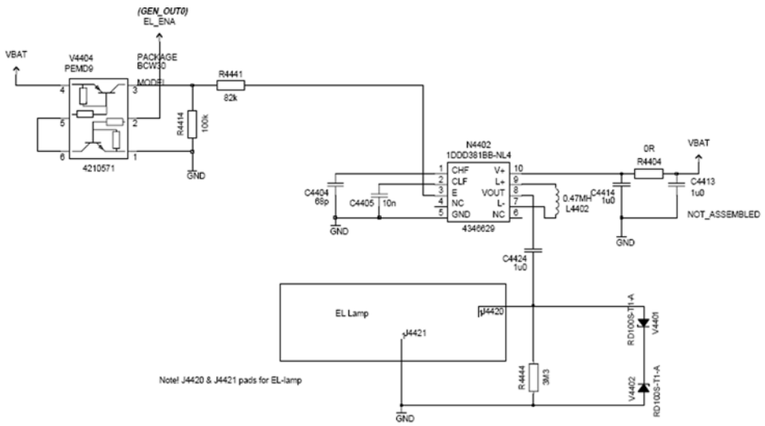

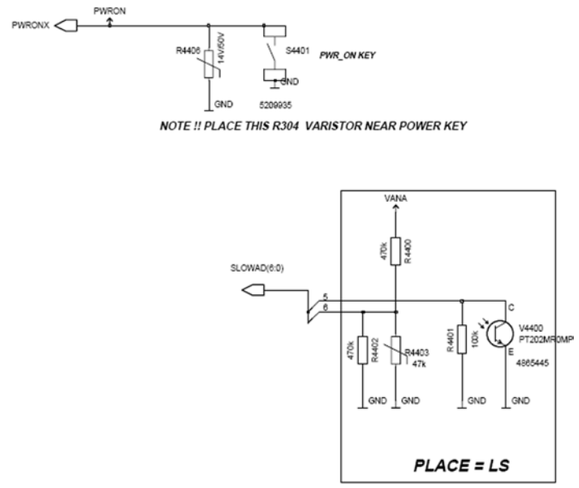

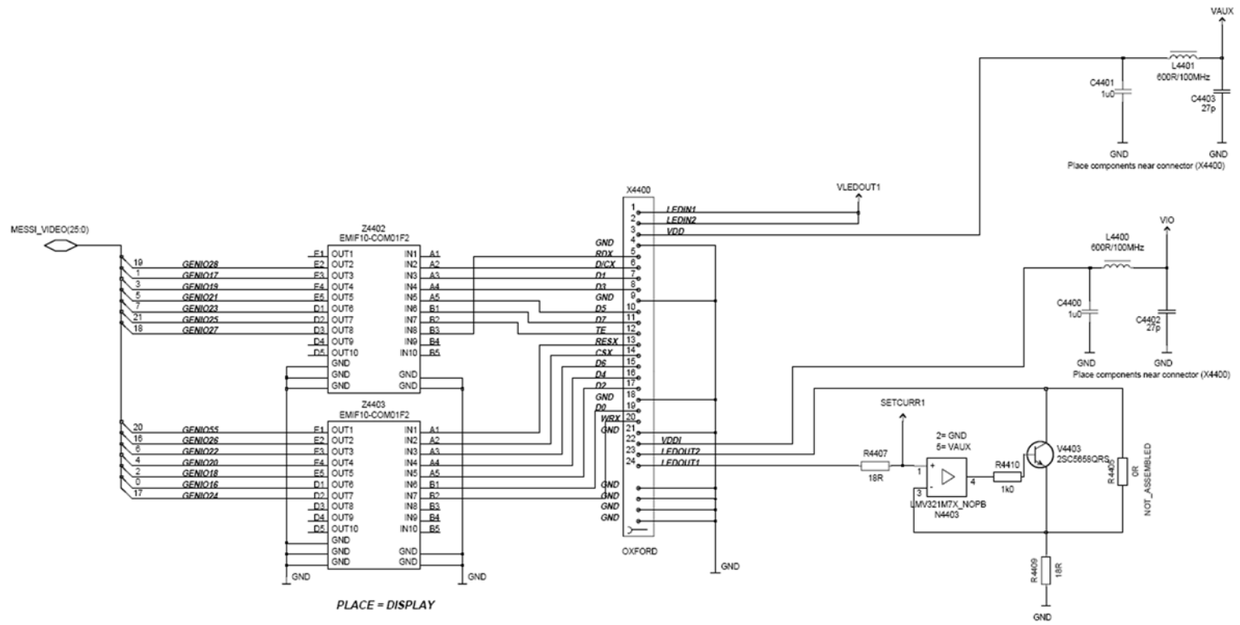

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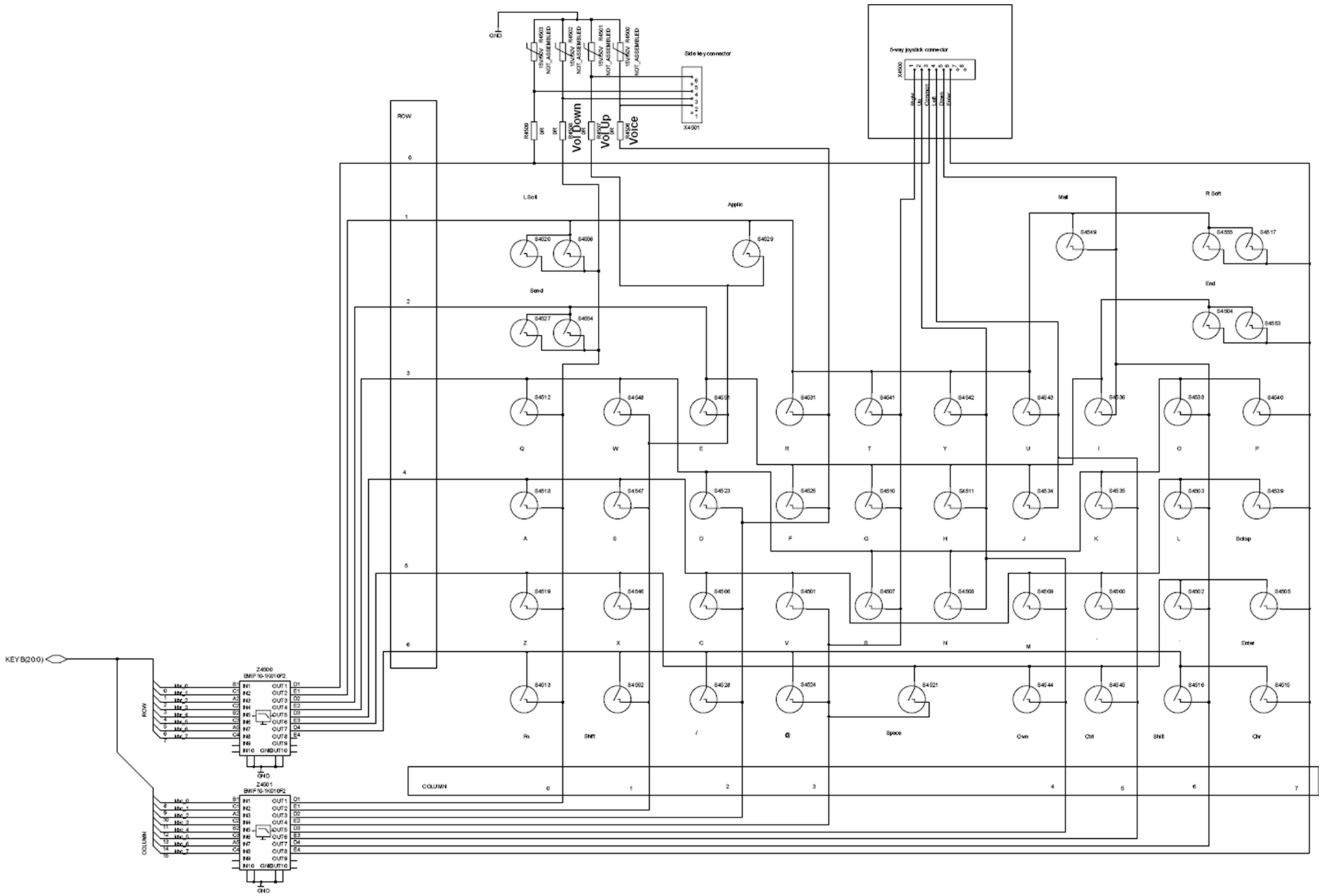

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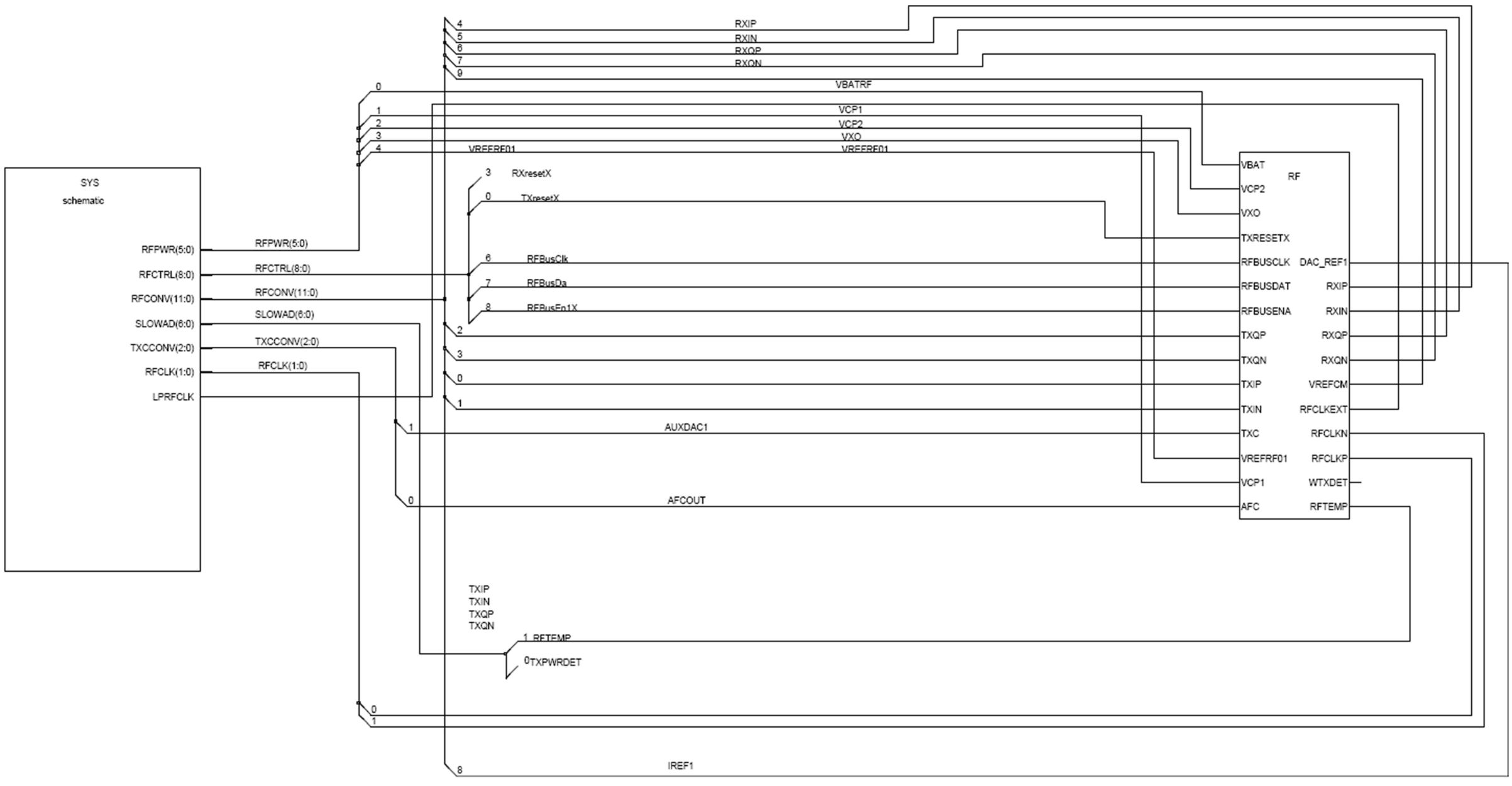

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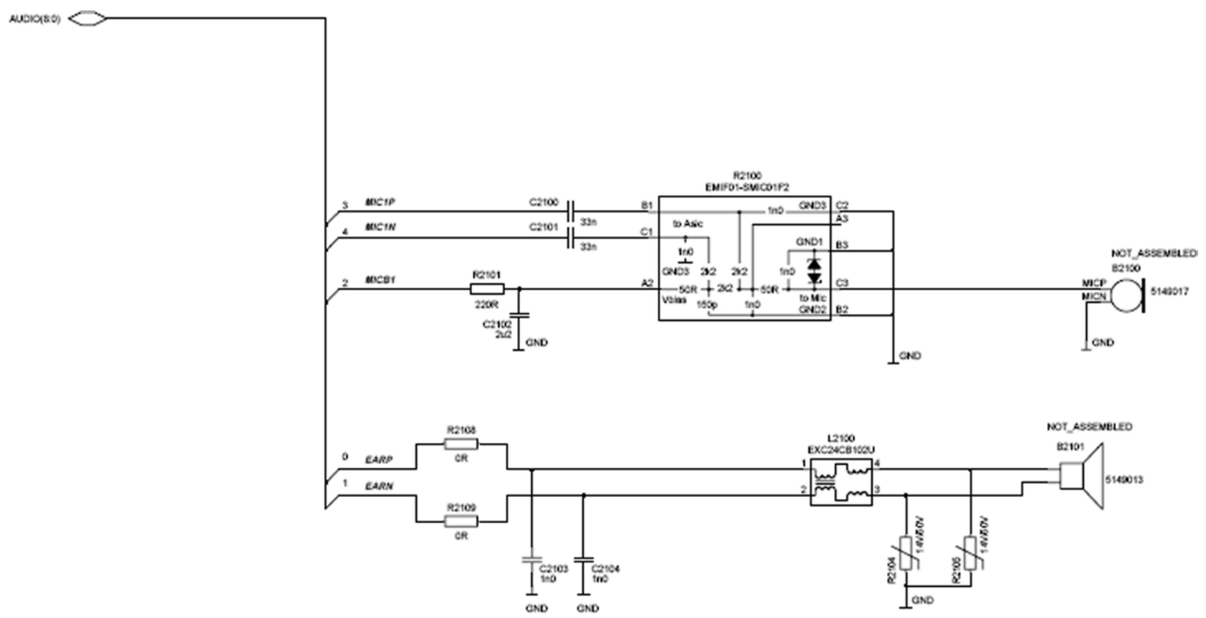

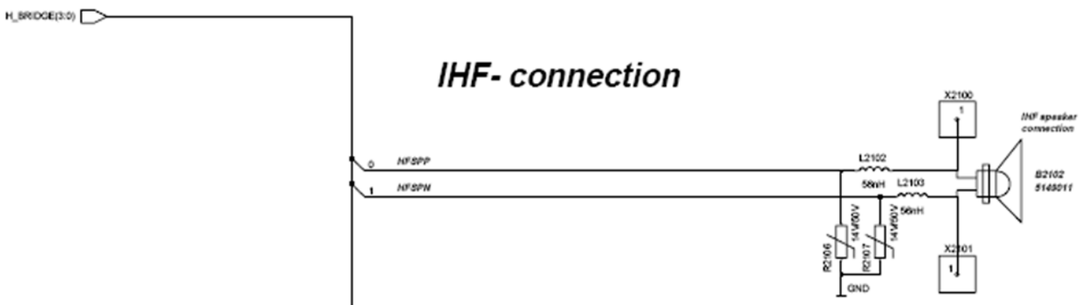

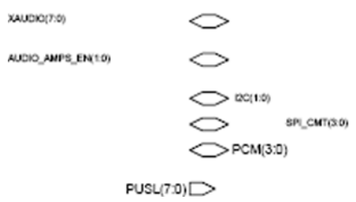

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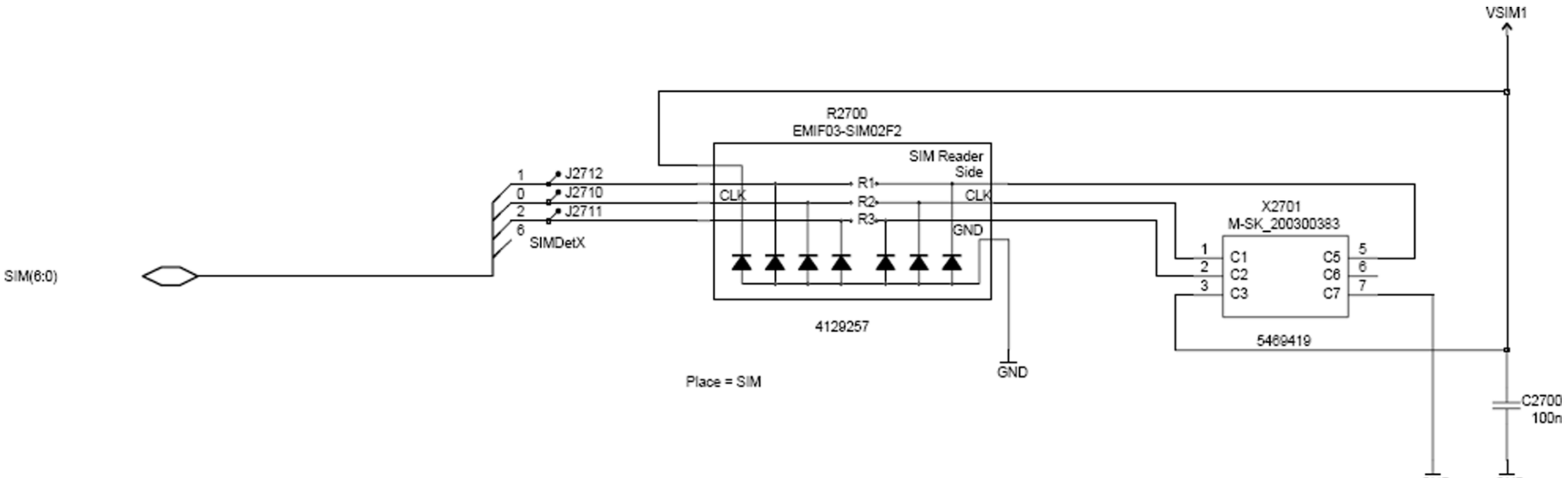

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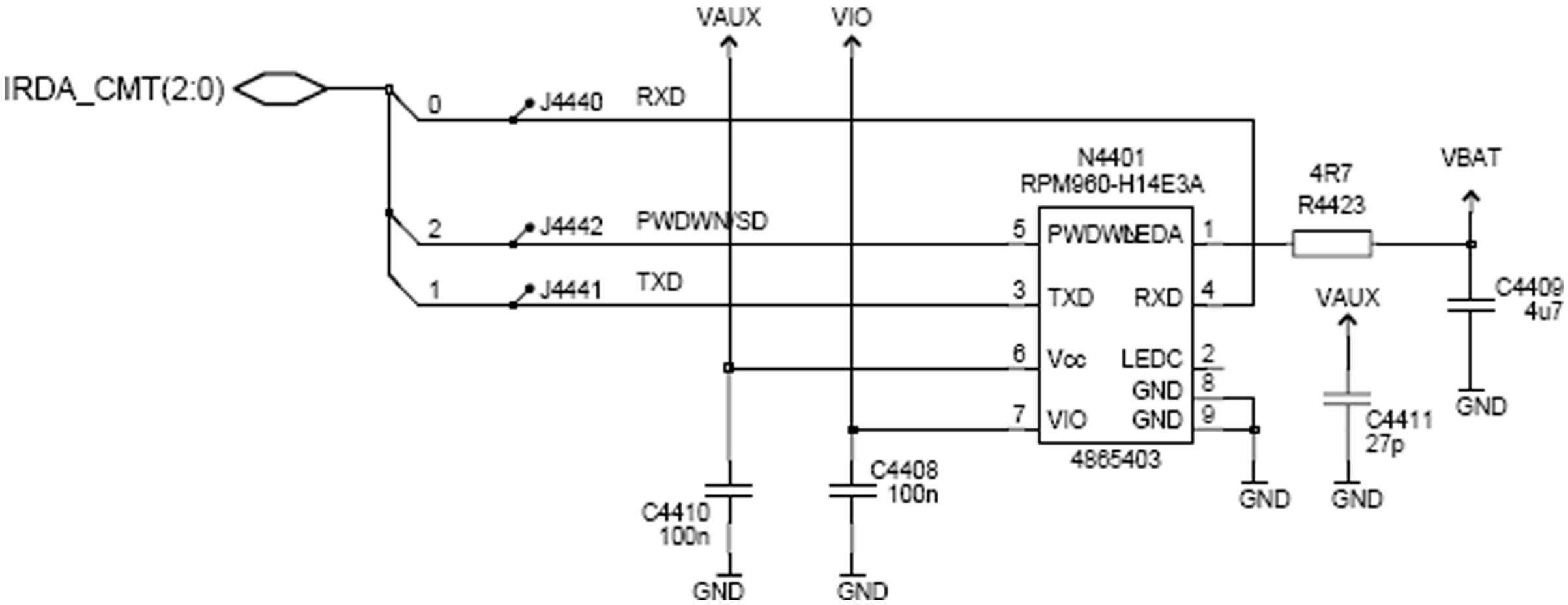

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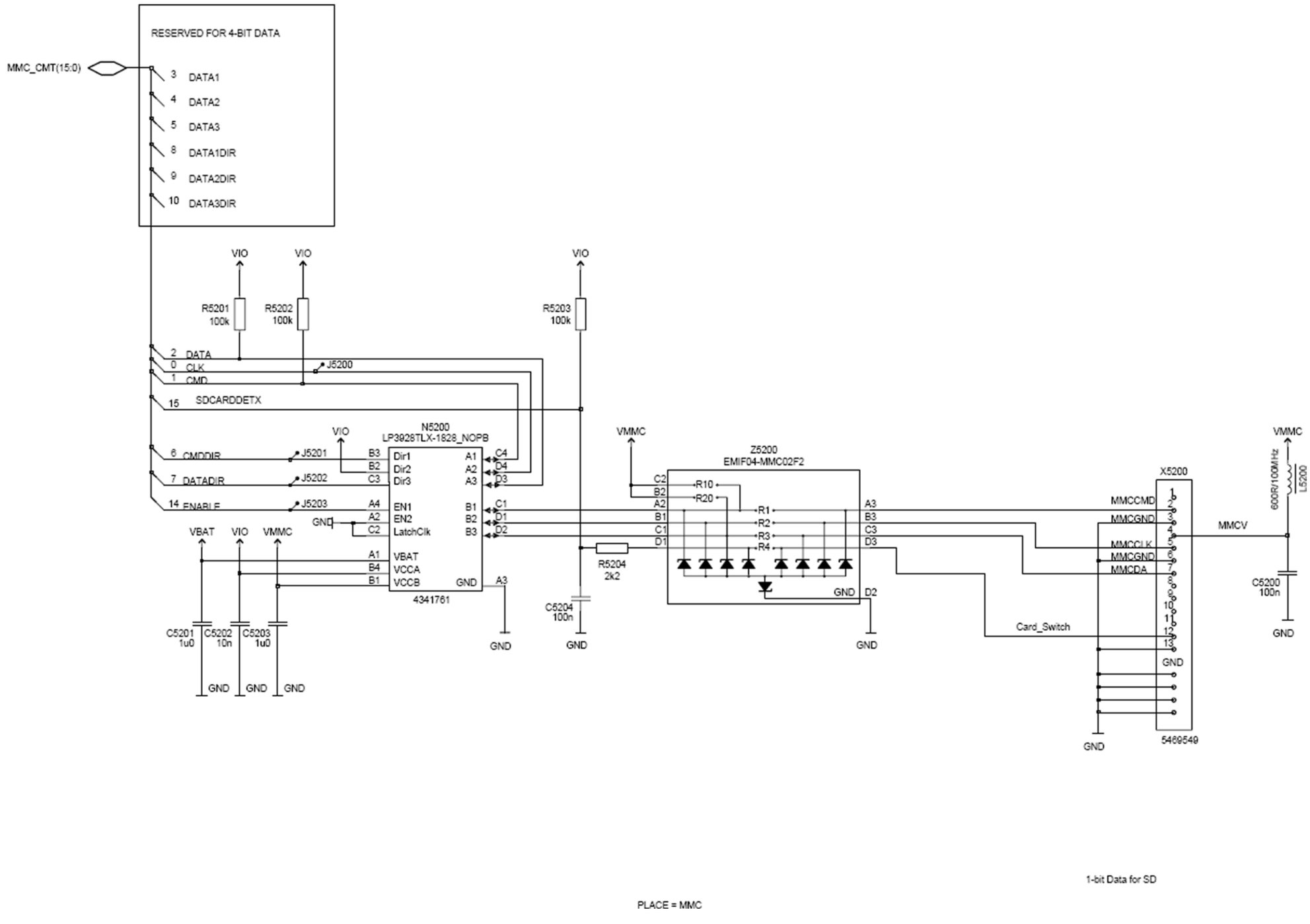

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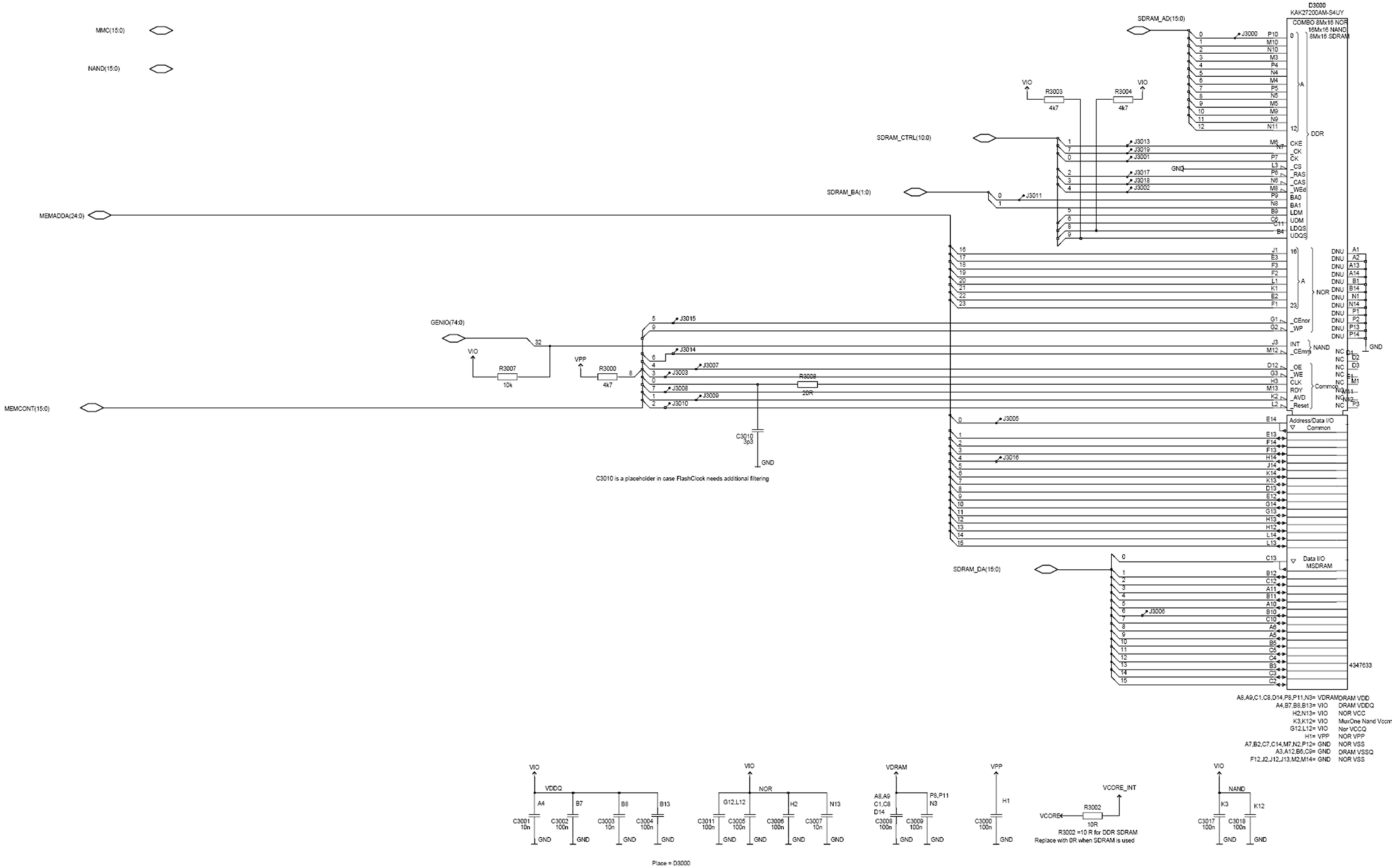

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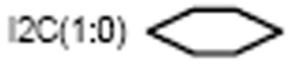

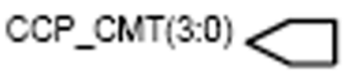

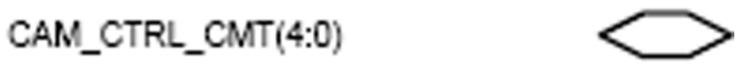

Glossary

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A/D-converter	Analog-to-digital converter
ACI	Accessory Control Interface
ADC	Analog-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic ,type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2,UEME and Zocus
CCP	Compact Camera Port
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSR	cambridge silicon radio
CSTN	Color Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analouge converter
DAC	Digital-to-analouge converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package

DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Associasion
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode

LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architechture
OMAP	Operations, maintenance, and administartion part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver

SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noice ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP, Official Tiku3G
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)